kilobaud

December 1981 USA $2.95

MICROCOMPUTING T.M.

A WAYNE GREEN PUBLICATION

Great Expectations

Will IBM, Xerox Deliver?

Most small system users think all microcomputers are created equal. And they're right. If you want performance, convenience, styling, high technology and reliability (and who doesn't?) your micro usually has a price tag that looks more like a mini. It seems big performance always means big bucks. But not so with the SuperBrain!

Standard SuperBrain features include: twin double-density 5¼" drives which boast nearly 350,000 bytes of disk storage — expandable to 10 megabytes. A full 64K of dynamic RAM. A CP/M* Disk Operating System to insure compatibility to literally hundreds of application packages presently available. And, a 12" non-glare, 24 line by 80 column screen.

You'll also get a full ASCII keyboard with an 18 key numeric pad and individual cursor control keys. Twin RS232C serial ports for fast and easy connection to a modem or printer. Dual Z80 processors which operate at 4 MHZ to insure lightning-fast program execution. And the list goes on! Feature after feature after feature.

Better yet, the SuperBrain boasts modular design to make servicing a snap. A common screwdriver is about the only service tool you'll ever need. And with the money you'll save on purchasing and maintaining the SuperBrain, you could almost buy another one. For under $3,500, it is truly one of the most remarkable microcomputers available anywhere.

Whether your application is small business, scientific, educational or just word processing, the SuperBrain is certainly an exciting solution to the small computer problem. And since you can easily expand it, you'll probably never outgrow it.

Call or write us today for a complimentary copy of our "SuperBrain Buyer's Guide." We'll show you how you can get big system performance without having to spend big bucks.

INTERTEC DATA SYSTEMS®

2300 Broad River Rd. Columbia, SC 29210
(803) 798-9100 TWX: 810-666-2115

*Registered trademark of Digital Research, Inc.

SUPERBRAIN™

MICROCOMPUTING

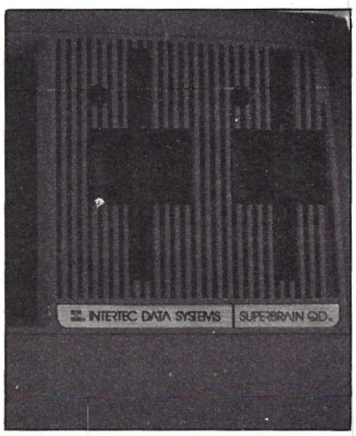
APPLICATIONS

BUSINESS

GENERAL INTEREST

HARDWARE MODIFICATIONS AND PROJECTS

PROGRAMMING TECHNIQUES



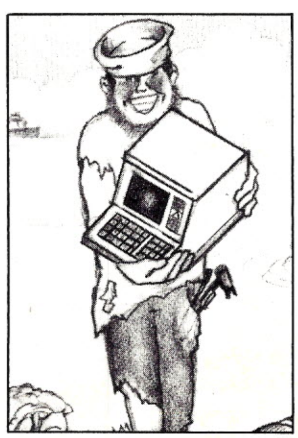
Page 52.

Page 86.

Contents: December 1981

Volume V
No. 12

Page 94.



Page 164.

This month:
Microcomputers: Toys or Tools?

Much has been written (in publications such as *Time*, *Business Week* and *The Wall Street Journal*) about the significance of the entry of IBM and Xerox into the realm of microcomputing. These giants have determined that microcomputing has reached a level and rate of growth sufficient to find it profitable for them to enter the market. How will these big-name microcomputers affect sales of *established* microcomputer manufacturers like Apple and Radio Shack? Regardless of immediate effects, the long-term result should be a boon to the entire industry. This, in fact, is the real question: Will the expectations of the industry come closer to realization because IBM and Xerox are now a part of the industry?

The entry of major computer companies into personal computing should definitely have a legitimatizing effect on the industry. The general public and, more importantly, the overall "computer community" will have to take a more serious look at what we are doing in the microcomputing field, which is rapidly becoming a major industry.

It has been disconcerting to meet recent computer science graduates who have never worked with microcomputers. Some are completely unaware that a microcomputer industry exists. More unsettling is the view of many in the computer industry, manufacturers and consultants, that the micro or personal computer is a toy that can do nothing serious.

The new major micro manufacturers have not introduced industry-revolutionizing products from a technical point of view (though IBM's use of the 16-bit 8088 processor with an eight-bit data bus results in a machine that should bridge the gap between older eight-bit and newer 16-bit microcomputers). But will they change the industry in other ways? We'll keep you updated on new software and peripherals for their computers.—**The Editors**

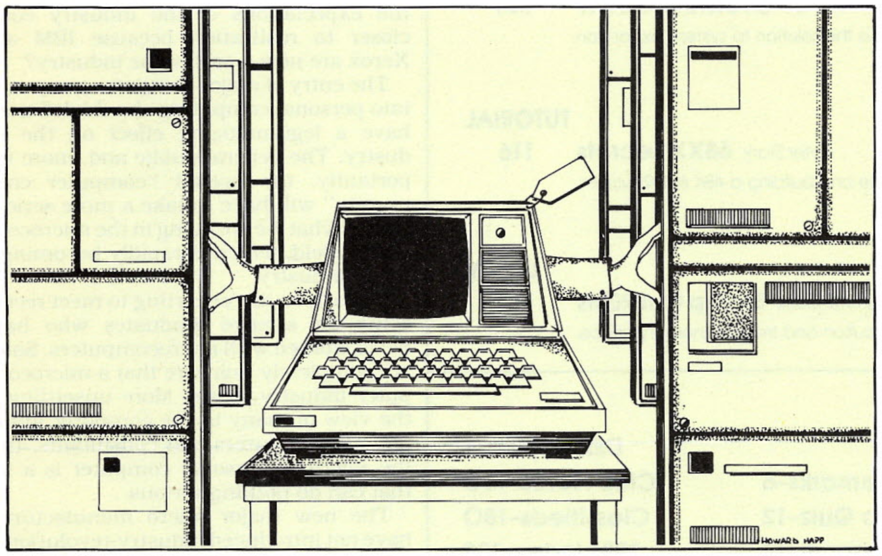
This month's cover:

Photo by Lighthearted Studio. Special thanks to Computerland of Nashua, NH, for their assistance in preparing this month's cover.

Kilobaud *Microcomputing* (ISSN 0192-4575) is published monthly by Wayne Green, Inc., 80 Pine St., Peterborough NH 03458. Subscription rates in U.S. are $25 for one year and $53 for three years. In Canada: $27 for one year only, U.S. funds. Foreign subscriptions (surface mail)—$35 for one year only, U.S. funds. Foreign air mail subscriptions—$62 for one year only, U.S. funds. Canadian Distributor: Micron Distributing, 409 Queen St. West, Toronto, Ontario, Canada M5V 2A5. In Europe, contact: Monika Nedela, Markstr. 3, D-7778 Markdorf, W. Germany. South African Distributor: KB Microcomputing, PO Box 782815, Sandton, South Africa 2146. Second-class postage paid at Peterborough NH 03458 and at additional mailing offices. Phone: 603-924-3873.

By Wayne Green

Devastating Truth About Minis



Mini Squeeze

With some amusement I read the article in the Sept. 28 *Business Week* explaining that the minicomputer pioneering firms are being hit hard by the growing market for microcomputers. A significant number of people have been buying $5000 word processors rather than the $15,000 models (which do precious little more).

These are the same folks who have been walking through the microcomputer section of the NCC exhibits for the last three years sneering at the toys. They are the same aloof folks who have not bothered to read this magazine and its editorials warning that just this would be happening . . . and soon.

I predict that there are going to be a lot more traumatized minicomputer firms and their attendant support software and peripheral firms as the word spreads about what our microcomputers can do . . . and how inexpensively.

Several factors are ganging up on the mini people which can't help but force many of them out of business. One of the more decisive of these is the general media's growing interest in micros, which is bringing the word of this low-cost computing power to businessmen. Aiding that are publications such as our new *Desktop Computing* which tell the businessman in plain language what these small computers are doing for other firms . . . and by extension what they can do for him.

Another important factor is the normal human tendency to try to keep the world from changing. Most firms go along spending 100 percent of their efforts trying to solve present time problems with the result that when a major change in technology comes along it can upset everything. With emphasis on developing some immediately needed software or an accessory, and on getting the sales department to get a slightly larger share of the market, few firms have anyone with the time to notice an approaching catastrophe.

Add to that the wonderful successes most of the mini firms have had, which have focused their attention on production and incremental changes in the product. The problems have involved keeping up with the demand and making deliveries, not coping with a competitor coming in from left field.

Minicomputer (and maxi) firms have been blinded, too, by the power of their equipment. They have not stopped to look carefully at the micro growth and noticed that these seemingly insignificant toys have been growing in their ability to tackle real work. Micro manufacturers have had to endure the overbearing attitude of the mini firm people at NCC ever since they started trying to show their systems. They would come by in small groups, making snickering remarks to each other and then go back to the main exhibits where they were comfortable with "real" computers.

The Mini Role

If the minicomputer firms are going to weather the next few years, they are going to have to get their people together, look closely at microcomputers and figure what segment of the market their systems fill which micros can't.

There is both good news and bad news for the minis. The bad news is that they can expect micros to be used for most of the smaller firms around the world . . . and thus there is a far larger overall market for micros than for minis. They can also expect to lose most of the desktop market, even in the larger firms, as businessmen opt for a combination computer/terminal rather than just a terminal.

The good news is that micros will bring computing to everyone, and the need for the more powerful mini systems will be better recognized. Larger firms will find that micros are too slow for their needs and move to larger and faster systems. Businessmen will be able to do most of their work on a micro, but will need a host mini for some specialized applications such as number crunching, large databases, networking and so on.

Until the mini people take off their blinders and put their systems into perspective from the viewpoint of the busi-

META TECHNOLOGIES

161

26111 Brush Avenue, Euclid Ohio 44132

CALL TOLL FREE 1-800-321-3552 TO ORDER

IN OHIO, call (216) 289-7500 (COLLECT)

1001 THINGS TO DO WITH YOUR PERSONAL COMPUTER

BY MARK SAWUSCH

333 pages $7.95

333 pages, written in simple terms, of "what-to-do" and "how-to-do-it". Suitable not only for microcomputers, but for programmable calculators as well. Includes program listings, formulas, a glossary of computer terms and more! Definitely a MUST BUY!

A PARTIAL LIST OF APPLICATIONS

Real Estate Evaluation	Test Your Typing Speed
Astrology	Finances & Investments
Income Tax	Biorythm
Speed Reading	Energy Efficiency
Personality Test	Antenna Design
Statistical Analysis	Letter Writing
Logic Circuit Analysis	Recipe Index/Calculator

Carpenter and Mechanic's Helper

General Purpose Clock Timer

"OTHER MYSTERIES" VOLUME III

by Dennis Kitsz

Call now and place your order for this new book, "THE CUSTOM TRS-80™ & OTHER MYSTERIES", from IJG, Inc. More than 300 pages, with over 60 photographs, of projects for the hardware hobbyist. Includes schematics, PC layouts, software driver code, etc. for such do-it-yourself undertakings as high resolution graphics, reverse video, real-time clock/calender, music synthesis, ROM/RAM additions and more!

THE CUSTOM TRS-80™ $29.00

CALL FOR AVAILABILITY

MICROPARAPHERNALIA

NEWDOS by APPARAT

NEWDOS/80 by Apparat $139.95
NEWDOS UPGRADE .... CALL
NEWDOS + with ALL UTILITIES
35-track $69.95
40-track $79.95

BOOKS

TRS-80™ DISK AND OTHER MYSTERIES .. $19.95
MICROSOFT™ BASIC DECODED $24.95

EPSON

MX-80, MX-80FT, MX-100

PRINTERS

CALL FOR PRICE

10 FT. RIBBON

CABLE

$24.95

CONNECTS EPSON PRINTER & TRS-80 MICROCOMPUTER

DISK DRIVE

EXTENDER CABLE

$9.95

for VISTA, MICROPOLIS, MTI, PERTEC, SHUGART, PERCOM & OTHERS

Let your TRS-80™ Test Itself With

THE FLOPPY DOCTOR & MEMORY DIAGNOSTIC

by David Stambaugh

A complete checkup for your MODEL I or MODEL III. THE FLOPPY DOCTOR-Version 3 completely checks every sector of single or double density 35-, 40-, 77-, or 80-track disk drives. Tests motor speed, head positioning, controller functions, status bits and provides complete error logging. THE MEMORY DIAGNOSTIC checks for proper write/read, refresh, executability and exclusivity of all address locations. Includes both diagnostics and complete instruction manual.

SYSTEM DIAGNOSTICS . $24.95
For MODEL III $29.95

Single Sided, Soft-Sectored 5¼-inch, (for TRS-80™) Mini-floppy

DISKETTES

$19.95 box of 10

PLAIN JANE™

These are factory fresh, absolutely first quality (no seconds!) mini-floppies. They are complete with envelopes, labels and write-protect tabs in a shrink-wrapped box.

PLAIN JANE™ Diskettes $19.95

PLAIN JANE™ *Gold*

Introducing MTC's premium generic diskette. Single-Sided, Soft-Sectored, DOUBLE-DENSITY, 5¼-inch diskettes with reinforcing HUB-RINGS. Individually 100% ERROR-FREE certified. Invest in GOLD!

PLAIN JANE™ *Gold* $24.95

VERBATIM'S PREMIUM DISKETTES

DATALIFE™

Seven data-shielding improvements mean greater durability and longer data life. These individually, 100% error-free certified diskettes feature thicker oxide coating, longer-lasting lubricant, improved liner, superior polishing and more! Meets or exceeds IBM, Shugart, ANSI, ECMA and ISO standards.

VERBATIM DATALIFE™ DISKETTES
5¼-inch (box of 10)
MD525-01 .... $26.95
10 boxes of 10 .... (each box)$25.95
8-inch FLOPPIES
Double-Density, FD34-8000 . $43.95

'RINGS' & THINGS

HUB RING KIT for 5¼" disks..... $10.95
HUB RING KIT for 8" disks....... $12.95
REFILLS (50 Hub Rings)......... $ 5.95
CLEANING KIT for 5¼" drives ... $24.95
5¼-inch diskette case $3.50
8-inch diskette case $3.95

5¼-inch File Box for 50 diskettes $24.95

8-inch File Box for 50 diskettes $29.95

MOST ORDERS SHIPPED WITHIN ONE BUSINESS DAY

Products damaged in transit will be exchanged.

PRICES IN EFFECT Dec. 1, 1981 THRU December 31, 1981.

Prices, Specifications, and Offerings subject to change without notice.

8112

WE ACCEPT

- VISA
- MASTER CHARGE
- CHECKS
- MONEY ORDERS
- C.O.D.

- Add $3.00 for shipping & handling
- $3.00 EXTRA for C.O.D.
- Ohio residents add 5½% sales tax.

nessman, they are sailing in dangerous waters. Their salesmen are going to have a tougher and tougher time pulling a con job on businessmen. The firms are going to have to have systems which really do what they claim.

Another Wall Crumbleth

A fair segment of the computer industry are the DP managers and systems analysts. These people are going to have to make some major readjustments to their way of life if they are going to survive in anything but decreasing numbers. One of the tools of their business in the past (and present) is the ignorance of the average businessman—and executive—about computers. This mystique has been kept intact through the use of a foreign language, used in many cases more as a smoke screen than for real communications. Magazines such as *Desktop Computing* will soon blow this cover, exposing DP managers to some searching questions which they will have to start trying to answer in plain English.

Indeed, the data processing professional who is not thoroughly familiar with microcomputers is already out of date. Any firm which hires someone to manage its data processing, or information management—or any of the other proliferating buzzword phrases for saying essentially the same thing—and does not make sure that the person is also an expert on microcomputers is asking for huge losses of its computer investments.

Now, I haven't done a specific study of the microcomputer literacy of DP people, but I do read all of the same magazines and papers they do and I'm reasonably sure that they, as a group, don't know beans about micros. *Computerworld* is a large and successful publication, but the attitude I've seen in it has been the same one I've seen at NCC—arrogant amusement with these insignificant upstarts. This can't help but poison the water for the professionals who read it every week.

The other publications read by the DP professionals have carried on in the same vein, helping them maintain their ignorance of microcomputers and their capabilities. It feeds on itself, with the writers and editors of these journals all being a part of the maxi and mini world and thus conditioned to ignore the new smaller systems.

School Debacle Too

Most of the colleges which have been teaching computing have built up systems based upon maxi or minicomputers, and the departments which have run these systems have been as biased against micros as everyone else in the computer field. The result has been a twisted perspective on the part of the students, who merely follow along with the same lack of respect for small (toy) computers.

Indeed, I've talked with many of the college DP people and found the prejudice against micros impenetrable. Even those who happen to get hired by a microcomputer publication have not been able to get over this bias.

Last year I talked with several colleges about setting up microcomputer courses. I found myself up against entrenched DP professionals who felt this would really be a waste of time for the students. Why should they bother to learn about computers with such limited capabilities? One of these professionals had put together an Altair computer, so he was even more convinced of his position as the owner of a microcomputer.

This attitude is beginning to change, but all too slowly for the good of the computing industry. We need people who have perspective on the place of microcomputers and minicomputers rather than bigotry. The firm hiring a new DP person has every right to expect an honest evaluation of its DP needs which will give it the most computing for the money spent. Today the larger firm has two and three quarters strikes against it in this respect.

The *Microcomputing* Reader

The totals for the reader surveys in the May and June issues of this magazine are in. Not bad! I'll try to get a detailed report available for advertisers and prospective advertisers, and just cover the highlights here.

Starting with the age of our readers, we had the largest group in the 25–35 year bracket, with the average age of the reader being 35. From an advertising point of view this is just about ideal because this is the group with the most money to spend. These people are right in the middle of their most productive years.

The annual income—averaging $29,250—surprised me. I was also amazed to see that 9.8 percent of the readers are making over $50,000 a year. Seventy-five percent are making over $20,000 a year. That helps to explain the remarkable success in selling stories we hear from advertisers.

Advertisers will be interested to learn that over two-thirds of our readers claim that they either make the purchasing decisions or have influence in these decisions when it comes to purchasing computer equipment for their company. How much will the average business be spending for computing power in the next year? If we make a wild guess and estimate an average investment of only $5000 per business—with our survey showing 220,000 readers per issue—this would net out at about $61 million per month being purchased just via our readers.

If these 147,400 *Microcomputing* readers don't see ads for a system, how can you expect them to think about it when it is recommendation time? That's about 12,000 microcomputer systems a month which are bought for business as a result of our readers. That doesn't include the systems they are buying for their own use.

One statistic which surprised me was that 22.9 percent of our readers have not yet bought a computer. There's a market for another 50,000 computers right off the bat. If we estimate the average investment at $2550 (which *was* the average claimed by our readers), that would point to a ripe market of $127 million in sales. That's only another $10 million a month if we figure to get all of them during the next year. But $10 million here and $10 million there . . . and soon you're beginning to talk about real money.

Kilobaud Microcomputing has been viewed by many ad managers as being hobby-oriented, so I was interested to see that about 60 percent of the readers are using their systems for other than personal computing applications. We did start out aimed largely at the hobbyists, which is what the market *was* in 1977. When I saw that the new breed of hobbyist was different from the old one, I changed the orientation of the magazine to satisfy the needs of this new group. I'm not sure that the word "hobbyist" is applicable, but we do need some definition for the person who has bought a computer and is now deeply involved in learning about it. *That* is the aim of *Microcomputing* magazine today.

A survey of the computer systems in use by the readers shows some substantial changes since our survey a year ago. Things *are* changing . . . and rapidly. For one thing, the percentage of Apple owners is catching up with the TRS-80 owners. Some of this obviously has to do with TRS owners changing their allegiance to *80 Microcomputing*. Indeed, we were a bit worried that the loss of TRS readers to *80* might hurt the circulation of *KM*. It did slow the growth down a bit, but that's all.

From the latest survey it looks as if we have something over 400,000 different readers for the two magazines. When you consider that *Byte* has about that and charges more for ads than our two magazines combined, there are some advertising bargains available for the shrewd buyer.

Comfortably in third place now is Heath, with almost double the percentage of the PET, which has been dropping steeply. That's a pity, but with virtually no advertising and a discouraged bunch of owners as a result, perhaps that was to be expected. In fourth place, coming up fast, is OSI. Over 12,000 of our readers have the OSI systems so far.

Well, that's enough of that. I'll try to have the dry details in our sister publication, *Microcomputing Industry*, a smaller magazine sent to the industry every month.

The New *Microcomputing*

Well, that's what manufacturers say when they make changes in their product. Since we're always making small changes in *Microcomputing*, perhaps we should put "new" on the cover every month. With a growing number of publications covering the microcomputer field, it is obviously important for us to keep in mind what you, the readers, want in a magazine. I've been trying to keep *Microcomputing* aimed at your needs and make it worth your while to spend the time needed to read it . . . and worth the money to buy it.

With well over a dozen magazines in the field, even if you could afford to subscribe to all of them you wouldn't have the time to read 'em. There's just too much information. So, if we are going to continue to be worth your time and money we have to provide what you need—the articles and programs which you will find of personal benefit.

I get every magazine in the field—and I try the best I can to read them—so I know what they're doing and what position they have in the field. I've tried to figure out what areas should be covered by my four computer publications so I can help the editorial staffs select articles which are consistent with what you need.

Starting with our newest magazine, *Desktop Computing*, we have a publication aimed at the businessman and educator to tell them in plain English what microcomputers are able to do . . . and offer avuncular advice on what goes into the selection and purchase of a system. This magazine also explains in plain language what all those peripherals and programs do for you.

Then there is *80 Microcomputing*, which is aimed at the owner of a TRS-80 computer. It offers extended documentation, evaluations of accessories and programs which are commercially available, plus a very generous supply of the best programs we can get . . . with both full listings in the magazine plus an available cassette dump of these listings. *80* is, I think, one of the most successful technical publications of all time. In less than two years it has gone to over 100,000 circulation and over 400 pages. Advertisers tell us that they've never seen a magazine that comes even close in selling power, which explains the steady increase in advertising and magazine size. It is not, like *Byte*, top-heavy with ads, running about 40 percent or so to their 60–70 percent and usually running about three times as many articles.

Microcomputing (*Kilobaud*) is aimed at the relative newcomer to computers, the person who has a computer and wants to learn as much as possible about using it. The documentation available from most system manufacturers is scanty, so if you are going to get much out of your investment in a computer you want to get all the information you can about using your system. You want to know what is available for it in accessories and in programs. And, considering the cost of packaged software, *Microcomputing* has a wealth of usable programs.

The more advanced computer owner, computer scientist and data processing professional may find my first magazine, *Byte*, a good bet, despite the small amount of editorial matter in each issue (15–20 percent). It's now published by McGraw-Hill.

In addition to my three main magazines, I also publish a smaller one for the industry called, imaginatively enough, *Microcomputing Industry*. This is sent to every known store selling computers, to all manufacturers of hardware for microcomputers and to all software firms. In this magazine I tell dealers how to sell and manufacturers how to manufacture, and discuss shows, methods of product distribution, the inside skinny on advertising and so on.

There are specialized publications for the Apple, Heath, Sinclair and other systems. These smaller magazines have some serious problems which are difficult to overcome. It is very hard for them to get first-rate material because they can't possibly meet the article payments authors get from the larger-circulation magazines. The same goes for the programs they publish. People who write programs are, like you and me, anxious to get all they can out of the work they have put in, so they look first for a software publisher who might be able to bring them hundreds or even thousands

✓See List of Advertisers on page 210

of dollars for their program. Next they look for the larger magazines. Here *Microcomputing* has a decided advantage, since programs submitted for it are also considered for publication by Instant Software, with all the royalties *that* can bring. In general then, once you are past *Microcomputing*, *80 Microcomputing*, *Desktop Computing* and *Byte*, you are likely to be reading material that has been rejected by the first teams.

Speaking of Instant Software, our program-publishing division is now rounding out its third year in business. If you are a programmer you should keep publishing houses such as this in mind. The market for packaged software is growing rapidly, with predicted sales going into the billions within a few years. With none of the systems manufacturers doing very much in the way of developing software, this represents a great opportunity for the home programmer to get a piece of the action in this amazing new field.

There is one other important benefit to *Microcomputing* as compared to, say, *Byte*. They have gone to around 200,000 circulation, which means that the ad rates are impossible for smaller firms, the ones most likely to give you the newest gadgets and best bargains. We have aimed at 100,000 circulation (with about half the advertising rates) so you will have better ads from which to choose. Perhaps, if you've picked up *Byte*, you've noticed the difference in the type of advertising.

Between this publication and *80*, we, too, have 200,000 circulation, only it is spread out in two complementary magazines. Advertisers wanting to reach everyone can advertise in both of our magazines, reaching as large a readership as in *Byte*. . . only perhaps less weighted with data processing professionals. Advertisers *not* selling TRS-oriented products can reach their prospective customers at half the cost. . . while TRS products can use *80*, again at less than half the cost of *Byte*. Perhaps this is why *80* has increased in ad pages this year far more than *Byte*. . . and last year also.

Our editors enjoy the competition with *Byte* and the other micro magazines. Remember that many of us here started and edited *Byte* in its early days. Alas, as it mentioned in the *Wall Street Journal*, I and the others here are a cross they have to bear. Why did I think of Robert Vesco and his problems when I read that?

At any rate, *Microcomputing* is edited to bring you the information you need as a microcomputer owner. It's aimed at the relative newcomer rather than the scientist or hardened professional. We have a lot of hobbyists reading us. . . and businessmen who want to better understand and use their systems. We *do* cover all computer systems, but since *80* goes into the TRS in depth, we do not give that system equal time here. If you have a TRS you really need to keep in touch via both magazines.

Program Theft

One of our Instant Software dealers in New York complained in frustration the other day that he really needs only one copy of each new program. Once that is sold, he claims, within days it is all over town, being given away by a chain of stores which sell computers.

It's difficult to tell whether he is right about this or whether he may be overreacting to one or two such cases. And if it *is* happening as he says, the question is whether this is something cooked up by a local group of these stores or whether it is a policy of the whole chain.

Another chap, who was involved with a major computer summer camp project put on by a well-known college in conjunction with a major computer manufacturer, claimed that the students were given copies of Instant Software programs by the instructors as part of the course.

Then we have the case of a recently-returned Instant Software program which was not made by Instant Software. It was a forgery.

In case there is even the slightest question in anyone's mind about this, all Instant Software programs are copyrighted. They are protected by law from being copied for sale or even for a gift. It is illegal to make a copy for anyone other than yourself.

The reason for this should be clear to anyone involved with computers. You know as well as I how much work is involved in writing a program. You probably have only a dim concept of the work and expense which goes into distributing that program, but the economics of this distribution are such that the programmer ends up with a bit over 10 percent of the retail price of the program. Believe me, if there was any way to make that higher we would. That's appreciably more than book authors generally get.

If programs are copied and exchanged, this is a loss to the programmer and to the program publisher. Each time there is a theft like this there is that much less chance of more good programs being written.

Since many people are able to rationalize away buying stolen property, whether it is a computer, a typewriter, a car or a program, obviously just depending on honesty for protection is a weak plan. In the case of Instant Software I have offered a $10,000 reward for information which enables us to get a conviction of someone copying our copyrighted programs. I am serious about it, even

This Months Special Okidata Microline 80 At a New Low, Low, Price!

Microline 80

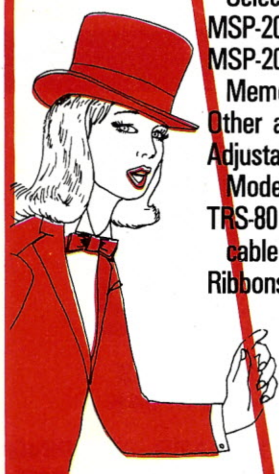
A great buy

– List Price is **$449.** The **Microline 80** is a quiet, small printer with field proven reliability.

Features:

- Friction & pin paper feed, roll or fan fold
- Prints expanded characters and block graphics
- Print speed 80 characters per second
- Printhead rated at 200 million characters continuous cycle
- 132-column compressed print
- Available RS-232C Serial Interfaces:

	LIST
ORS-256 (256 Character Memory)	$109.00
MSP-100 (Unbuffered, Switch Select Data Rates)	$120.00
MSP-200X (200 Character Memory)	$215.00
MSP-2000X (2000 Character Memory)	$300.00
Other available options:	
Adjustable Tractor Feed - Model 54100201	$ 50.00
TRS-80 Parallel Output, cable to printer	$ 35.00
Ribbons	$ 3.00



TRANSFORM YOUR COMPUTER

into a Word Processing or Data Processing System by adding one of the NEW Okidata Printers

Microline 83A

Microline 82A

If you require a system printer, the new Okidata Microline 82A, 83A, 84 should be your choice.

These printers feature:

- 9 x 9 Dot Matrix heads rated at 200 million characters continuous duty - true lower descenders
- Full forms control – vertical tab, top of form
- Block Graphics
- Bidirectional, Short Line Seeking
- Dual Interface – Parallel & RS-232C Serial

	LIST
Microline 82A – 80-column, 120 characters per second	$ 649.
Tractor Optional	$ 50.
Microline 83A – 136-column, 120 cps, built-in tractor	$ 995.
Microline 84 – 136-column, 200 cps, built-in tractor	$1395.
Optional Serial Interfaces – RS-232C:	
HS-RS232 – 256 Character Buffer	$ 150.
HS-RS232 – 2K Character Buffer	$ 180.

THE STOCKING SOURCE

ASK FOR OUR INSTANT DISCOUNT
From Roy Hawthorne
Talk To Bill Tokar On Applications

CALL TOLL FREE
U.S.A.
1-800-521-2764
MICHIGAN
1-800-482-8393

Remember:
We are open
8:30 AM to
6:00 PM EST
Monday – Friday

master charge THE INTERBANK CARD VISA

No Credit Card Penalty

"The Stocking Source"
24069 Research Drive
Farmington Hills, MI
48024
313-474-6708 ✓296

✓See List of Advertisers on page 210

though the *Whole Earth* people have called me a fascist for this.

I figured that it would take something substantial to break down the normal reluctance to be involved, even when a crime is being perpetrated. $10,000 can do a lot of things for you . . . such as an all-expense paid trip around the world for two . . . or a very big microcomputer system. The main purpose of the large reward was to discourage stores from giving away copies of Instant Software programs. Also schools, clubs and so on.

These thefts are not penny-ante, by the way. The New York caper has been estimated to have cost Instant Software in the neighborhood of $750,000 in sales so far, while that summer camp theft has been estimated to be over $500,000. You may be sure that should we get someone to come forth and testify against a store, a manufacturer, a school or a club that the damage claims will be substantial.

Speaking of clubs, if you are a member of an unincorporated computer club and that club is engaged in swapping programs, you should know that *you* can be sued as a member of the club, even if you had nothing to do with the program theft. If a software publisher sues a club, they will, in all probability, go after every member of the club . . . and particularly be on the lookout for any members with assets which will make them more sueable than the others. Incorporated clubs are a bit safer, but you are asking for it if you belong to any club which engages in program theft.

I am looking for anyone who will come forth and bring evidence of the copying of any Instant Software package. Copyright infringement cases are not difficult to prove and there is a long line of court cases where large awards have been given. Indeed, I know of some map publishers who make hundreds of thousands of dollars in such awards every year . . . mostly from small firms and clubs who have innocently used a map in their advertising or promotions, but not reckoned with the copyright problems. The penalties can be stiff . . . all out of proportion to the crime.

Before I succumb to pressures from the Instant Software people to encode programs so they can't be listed . . . or even go to a system which will require a hardware gadget as part of the decoding . . . I think it's worth a big try at getting the cooperation of *Microcomputing* readers.

Please keep your eyes peeled for any program theft. If you run into it I would appreciate a letter. If you are chicken and are afraid to openly blow the whistle, either don't sign the letter or ask for confidentiality. I would much prefer you go for the $10,000 and work out a system for getting a program copy which will stand up in court when we go after the thieves. You may want to use a hidden tape recorder (I always have a microrecorder with me), a friend with a small camera . . . or the cooperation of a friend in testifying.

The very least we can do at the present is make it quite clear that when anyone gives or gets a program from a friend, in a store, at a club, in school, etc., that both parties are well aware that this is a theft . . . that the penalties are severe and not a casual matter. You may be sure that no one is going to enter a suit for any small amounts . . . they will be big, even against individuals such as school children. Just the legal costs alone could put a good percentage of the computer stores out of business.

Should you find yourself tempted to run off a copy of an Instant Software program for someone, be awfully careful that he is not entrapping you for that trip around the world for two. He can always find new friends, but how often will he get a trip like that?

Anticopy Programs

There is a need for a good deal more work on both the simple hardware solution to the copying problem . . . and a possible software solution. Perhaps it is getting time to just forget about trying to work with honest people and prepare products to thwart the crooks. Yes, this will make it very difficult to ever make any changes in the program . . . or to use it as a teaching tool to learn more about programming. It will also prevent simple repairs in case you make a mistake in loading. I don't like that any better than you . . . but *something* has to be done. What do *you* suggest?□

Tax Deductible

Treasury regulation 1.162–5 permits an income tax deduction for educational expenses undertaken to maintain or improve skills required in one's employment or business.

Since computer literacy is a skill required in virtually any business these days, a subscription to *Kilobaud Microcomputing* or even the purchase of a new computer would be tax deductible in most instances.

MICRO QUIZ

Digital Electronics

Draw the most simplified circuit (the one that minimizes the number of gates used) that takes one-bit numbers as inputs and outputs the least significant bit of their sum.

Answer on page 238.

✓See List of Advertisers on page 210

PET-POURRI

By Robert Baker

VIC Expands Its Horizon

RS-232 Interface Announced

VIC-20 RS-232 Interface

Commodore has finally included an RS-232 interface in the new VIC-20, after several model PET and CBM machines. Since the RS-232 is much more common than the IEEE-488 interface, you should have less trouble finding printers, modems and other peripherals to connect to the VIC. Keep in mind, though, that a special adapter cable will probably be needed, since Commodore did not use a standard RS-232 connector. You should take a little time to understand how the new interface works before trying to use it.

The RS-232 interface has four levels of operation: the BASIC level (as seen by the program), the buffer system, the operating system byte/bit handling, and the special hardware required for proper voltage levels.

The BASIC-level interface uses the normal BASIC commands: OPEN, CLOSE, CMD, INPUT#, GET#, PRINT# and the reserved variable ST. The operating system byte/bit-level handler runs under control of 6522 device timers and interrupts. The 6522 generates non-maskable interrupt (NMI) requests that allow background RS-232 processing during normal program execution.

There are special software routines within the operating system to prevent disruption of data transfers by the RS-232 routines. Thus, during cassette or serial bus activities data cannot be received from RS-232 devices.

The VIC-20 RS-232 interface is bidirectional with a 256-byte first-in/first-out (FIFO) buffer for each direction. The opening of an RS-232 channel allocates these 512 bytes of system memory at the top of user memory. If there isn't enough free space above the BASIC program text, no error is indicated, but the program will be damaged. The INPUT# and GET# commands fetch data from the receiving buffer while PRINT# and CMD commands place data into the transmitting buffer. The buffer allocation is then reversed by a CLOSE command.

Only one RS-232 channel should be open at any time. A second OPEN statement will reset the buffer pointers, and any untransmitted or received data will be lost. Also, if an RS-232 channel is to be used, the OPEN command should be performed before any variable or DIM statements. The opening of an RS-232 channel also performs an automatic CLR command which will destroy any previously defined values. Remember that the program will be destroyed if there are less than 512 bytes of space available at the time of the OPEN statement.

When the RS-232 channel is opened, up to four characters can be sent in the filename field of the OPEN statement. The first two are the control and command register values that determine how the interface will function. The last two are reserved for future system options and should be avoided at present.

The control register values select the number of stop bits (one or two), the serial word length (five to eight bits), and the data rate (50 to 2400 bits/second), as shown in Fig. 1. The command register

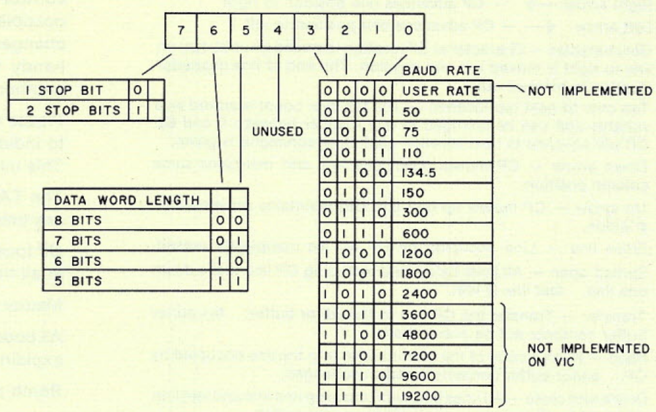


Fig. 1. VIC-20 serial port control register.

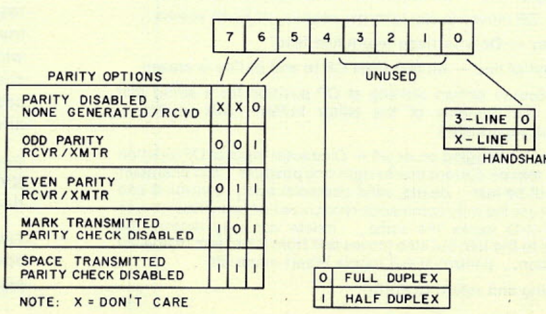


Fig. 2. VIC-20 serial port command register.

Address correspondence to Robert Baker, 15 Windsor Drive, Atco, NJ 08004.

values select the parity options, full- or half-duplex mode and the handshaking options, as shown in Fig. 2.

These figures can be used to easily find the correct bit configuration when computing the control characters to configure the RS-232 port. You should be aware that there is no error checking on the control word to detect a non-implemented bit rate. An illegal value in the lower four bits of the control register will cause the system output to operate at a slow rate (below 50 bps).

When receiving data, the VIC system internal receive buffer will hold 255 characters before a buffer overflow is indicated in the RS-232 status (ST). If this occurs, all characters received while the buffer-full condition exists are lost. Keep in mind that BASIC is slow in normal handling of data, and frequent garbage collects by the operating system will probably cause the receive buffer to overflow. If you want to input data at high bit rates you'll probably need machine-language routines to handle the higher speed interfacing.

The normal GET# and INPUT# commands are used to fetch data from the receive buffer. If a GET# command does not find any data in the buffer, a null character ("") is returned as expected. When an INPUT# command is used, the system will hang until a non-null character followed by a carriage return is received.

If the RS-232 CTS or DSR control lines disappear during character INPUT#, the system will hang until it is restored. This is why the GET# command is highly recommended for fetching data from the VIC serial interface.

When sending serial data, the output buffer can hold 255 characters before a full-buffer hold-off happens. The system will wait in the output routine until transmission is allowed or the restore key is used to recover the system.

There is no carriage return/line feed delay built into the output channel, so some RS-232 printers will not print correctly unless some form of hold-off or internal buffering is implemented by the printer. If an RS-232 CTS handshake signal is implemented, the VIC buffer will fill and discontinue output until transmission is allowed. Or the program can send a number of null characters to allow an appropriate delay before sending another printable character. This was a common method used with older Teletypes for printing without fancy handshaking lines.

For example, assume you need a one-second delay after a carriage return and you are using a 300-bits-per-second interface. With ten bits per character (1 start + 8 data + 1 stop), that's 30 characters per second. Thus, sending 30 null characters following the carriage return will insure the printer has time to complete the operation and will be ready to print again.

If the printer finishes early, the null characters are just ignored, since they're nonprinting characters. Any characters sent while the printer was busy performing the carriage return just won't be seen by the printer while it's busy.

When you are through with the serial interface, closing the RS-232 file discards all data then in the buffers, stops all bit transmitting and receiving, sets the RS-232 RTS and Sout lines high, and deallocates the RS-232 buffers. You should be careful that all data has been transmitted before closing the channel. One way to check this from BASIC is:

```
100 IF ST=0 AND (PEEK(37151) AND 64)=1 GOTO 100
110 CLOSE 1f#
```

As shown here, the RS-232 status register can be read from BASIC using the ST variable following an operation to the serial channel. However, when ST is read the RS-232 status word is cleared. Therefore, you should reassign the value of ST to another variable if multiple compares are desired. Fig. 3 shows the meaning of the individual binary bits in the RS-232 status register. Remember that the value read is in decimal and must be converted accordingly.

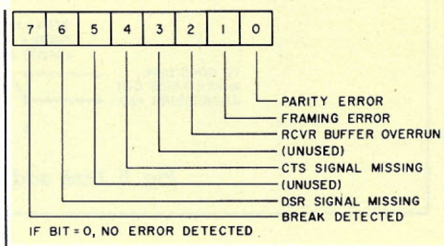


Fig. 3. RS-232 status register.

For those who may be interested, I've included a list of low memory addresses used by the serial interface (see Table 1) and information on the various RS-232 control and signal lines (see Table 2).

Two Disks

Having both 4040 and 8050 disks is a real luxury, but there is one small drawback. The disk drives are normally set as

Address Hex	**Dec**	**Usage**
$00A7	167	Receiver input bit temp storage
$00A8	168	Receiver bit count
$00A9	169	Receiver flag, start bit check
$00AA	170	Receiver byte buffer/assembly location
$00AB	171	Receiver parity bit storage
$00B4	180	Transmitter bit count
$00B5	181	Transmitter next bit to be sent
$00B6	182	Transmitter byte buffer/disassembly location
$00F7	247	Two-byte pointer to receiver buffer base loc
$00F9	249	Two-byte pointer to transmitter buffer base loc
$0293	659	Pseudo 6551 control reg (see Fig. 1)
$0294	660	Pseudo 6551 command reg (see Fig. 2)
$0295	661	Two-bytes following control and command in file name field (for future use)
$0297	663	RS-232 status register (see Fig. 3)
$0298	664	Number of bits to send/receive
$0299	665	Two-bytes equal to time of one-bit cell (based on system clock and baud rate)
$029B	667	Byte index to end of the receiver FIFO buffer

Table 1. Low memory addresses for RS-232 interface.

Pin ID	**6522 Pin**	**Abv**	**Description**	**Line Interface**
C	PB0	Sin	Received data	3 X
D	PB1	RTS	Request to send	3 X
E	PB2	DTR	Data terminal ready	3 X
F	PB3	RI	Ring indicator	
H	PB4	DCD	Received line signal	X
J	PB5	xxx	(Unassigned)	
K	PB6	CTS	Clear to send	X
L	PB7	DSR	Data set ready	X
B	CB1	Sin	Received data	3 X
M	CB2	Sout	Transmitted data	3 X
A	GND	GND	Protective ground	3 X
N	GND	GND	Signal ground	X

Table 2. RS-232 control and signal lines. (6522—location $9110#$911F)

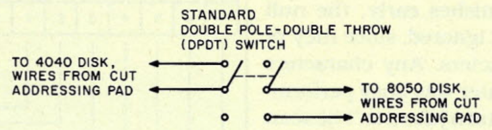


Fig. 5. Disk address select switch.

device #8 on the IEEE bus when shipped from the factory. When you have two disk drives, one drive has to be changed to another device address. You can only have one device on the IEEE bus that responds to a given bus address. If both disk drives are the same type, there's no problem—you or the dealer must simply change the internal address selection of one drive permanently and forget about it.

If you have two different disk types (say, a 4040 and an 8050), then a new problem arises. Most current disk software is written so it will only work with the disk addressed as device #8. Furthermore, some programs are only available for one particular drive. Modifying a major software product could be a rather complicated task, and then you'd have separate versions for each disk. You really don't want to permanently change the device address of either disk, since it would impose serious limitations.

One simple solution is to connect only one drive at a time, with both disks still set as device #8. This allows you to use any software package, but you have the inconvenience of having to switch cables to use a different disk type. Also, you've paid for two separate disks but you can only use one at a time.

I routinely test many different software packages that are written for many different configurations, and I've come across a much nicer solution that turns out to be extremely convenient. Basically, it involves connecting an external switch to one of the internal bus address select lines in each disk drive. When wired correctly, one disk will be device #8 while the other will be device #9. When the switch is changed, the device addresses are reversed. Thus, either disk can be the primary disk (device #8) while both disks are always available.

I would strongly recommend having your local dealer make any changes inside the disk drive if you're not skilled in these matters. Otherwise, be extremely careful near the disk drives themselves as they are very sensitive to dirt, vibration, etc. Also, the printed circuit board contains MOS devices that can be easily damaged by static electricity. It's best to leave the work to a trained technician if you're in doubt.

For whoever is doing the modification, the IEEE bus address is determined by three pads on the printed circuit board. They are located to the left of the IC marked "UE1" (see Fig. 4), and are in roughly the same location in both the 4040 and 8050 disks. These pads are normally shorted on the board, but may be cut to change the bus address as desired. Each pad has a binary value of 1, 2 or 4, as shown in the diagram. By cutting one or more of these pads, the corresponding value is added to 8 to create the new bus address. As expected, the disk must be device 8 through 15 on the IEEE bus.

To connect an external switch, you simply cut the bottom pad in both disks as shown in Fig. 5. Then carefully solder a wire to each side of the cut pad and attach to the external switch. When the external switch is closed the disk is device #8 as normal. If the switch is open, the disk will be device #9. The switch can be mounted wherever convenient. Mine is mounted on the back of one disk unit, out of harm's way. Maybe someday Commodore will make it easy for us by adding switches for device address selection.

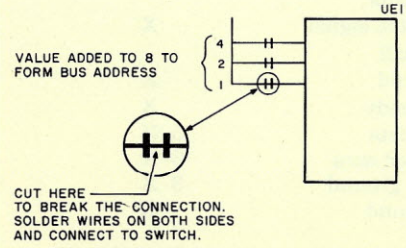


Fig. 4.

Screen Print Fix

In the May 1981 column I used a simple screen print program as an example while talking about machine-language programming. I mentioned in the column that the method used may not be the preferred way to use the IEEE printer from a machine-language program, but it does work.

A reader from Italy recently sent in a simple change to the routine that eliminates a minor problem. As written, the routine will leave the selected printer with the printer's LED on when the routine ends. This can be fixed by adding one more subroutine call at the end of the routine. However, the two constants after the routine must be moved and their references fixed to allow for the additional instruction.

To correct the source program, add a JSR $7183 instruction just before the RTS instruction at the end of the routine. This changes the hex locations as shown in Table 3.

I've included new monitor displays and a disassembly listing to make things easier for those who may want to add the changes.□

Hex location	**New hex data**
$039D	$D3
$03A4	$D4
$03CF	$20
$03D0	$83
$03D1	$F1
$03D2	$60
$03D3	$40
$03D4	$20

Table 3. Hexadecimal values for updating Screen Print assembly-language program.

```
N:CORRESPONDING MEMORY DUMP
N:FOR SCREEN PRINT ROUTINE FIX
N:
M:0384-03D4   0  1  2  3  4  5  6  7
W:0384-038B  A2 04 8E D4 00 20 BA F0
W:038C-0393  A0 00 A9 80 8D 98 03 8C
W:0394-039B  97 03 B9 00 80 29 7F 18
W:039C-03A3  2C D3 03 F0 02 69 40 2C
W:03A4-03AB  D4 03 D0 02 69 40 20 28
W:03AC-03B3  F1 C8 C0 28 D0 E4 A9 0D
W:03B4-03BB  20 28 F1 A9 0A 20 28 F1
W:03BC-03C3  98 18 6D 97 03 8D 97 03
W:03C4-03CB  90 03 EE 98 03 A0 00 C9
W:03CC-03D3  E8 D0 C7 20 83 F1 60 40
W:03D4-03DB  20 00 00 00 00 00 00 00
```

Table 4. Corresponding memory dump for Screen Print routine fix.

```
N:SCREEN PRINT ROUTINE - FIX
N:FROM MAY '81 COLUMN
N:
D:0384-03D2   1  2  3   MNC-CODE
I:0384       A2 04      LDX =$04
I:0386       8E D4 00   STX $00D4
I:0389       20 BA F0   JSR $F0BA
I:038C       A0 00      LDY =$00
I:038E       A9 80      LDA =$80
I:0390       8D 98 03   STA $0398
I:0393       8C 97 03   STY $0397
I:0396       B9 00 80   LDA $8000,Y
I:0399       29 7F      AND =$7F
I:039B       18         CLC
I:039C       2C D3 03   BIT $03D3
I:039F       F0 02      BEQ $03A3
I:03A1       69 40      ADC =$40
I:03A3       2C D4 03   BIT $03D4
I:03A6       D0 02      BNE $03AA
I:03A8       69 40      ADC =$40
I:03AA       20 28 F1   JSR $F128
I:03AD       C8         INY
I:03AE       C0 28      CPY =$28
I:03B0       D0 E4      BNE $0396
I:03B2       A9 0D      LDA =$0D
I:03B4       20 28 F1   JSR $F128
I:03B7       A9 0A      LDA =$0A
I:03B9       20 28 F1   JSR $F128
I:03BC       98         TYA
I:03BD       18         CLC
I:03BE       6D 97 03   ADC $0397
I:03C1       8D 97 03   STA $0397
I:03C4       90 03      BCC $03C9
I:03C6       EE 98 03   INC $0398
I:03C9       A0 00      LDY =$00
I:03CB       C9 E8      CMP =$E8
I:03CD       D0 C7      BNE $0396
I:03CF       20 83 F1   JSR $F183
I:03D2       60         RTS
```

Program listing. Screen Print routine fix.

EXCITING NEWS FOR TRS-80™ MODEL III USERS!

Standard & Poor's unique software and data system—STOCKPAK—can help you manage your investments like a Wall Street Professional! Now for TRS-80 Model I and Model III users too!

STOCKPAK not only delivers a "stand-alone" Portfolio Management System but also gives you the software for Standard & Poor's monthly Common Stock Data Service (available to TRS-80 owners on a subscription basis). With STOCKPAK and the Data Service you command one of the most powerful and versatile investment tools available.

Here's How STOCKPAK Will Help You:

A 900 COMPANY DATA BASE SERVICE

Monthly Data Service subscribers receive a diskette containing 30 vital financial items on 900 of the most widely traded stocks (S&P "500" and 400 NYSE, ASE and OTC issues). Accompanying this monthly diskette is an Investor's Newsletter highlighting important financial news and investment strategies, with suggestions for maximizing the usefulness of the system.

STOCKPAK SELECTION SYSTEM

The heart of STOCKPAK is a powerful, analytical stock selection tool which enables investors to choose stocks which meet their investment criteria. For example, you may wish to select only those oil and gas stocks with price/earnings ratios of less than 7 and yields of 6% or more. Once a group of stocks has been selected, you can store it as a separate data file for continuing use.

REPORT WRITER

You can define the report formats you would like to see on those stocks meeting your investment objectives. Hundreds of calculations and ratios that you define can be sorted, averaged or totalled, and displayed on video screen or optional printer.

PORTFOLIO MANAGEMENT SYSTEM

Now you can effectively evaluate and manage your own stock portfolio of up to 100 securities with as many as 30 transactions for each. You can record "buy" and "sell" transactions, price and dividend information and stock splits for instant retrieval, for record keeping and tax purposes. You can measure actual performance or create hypothetical situations to help you make "buy" or "sell" decisions.

HOW TO ORDER STOCKPAK

STOCKPAK is designed exclusively for TRS-80 users with 32K business systems with two mini-disk drives. You can obtain the basic software and sample Data Base, plus a comprehensive User's Manual from your local Radio Shack Store for only $49.95. The STOCKPAK Monthly Data Updating Service can be ordered directly from Standard & Poor's for $200 annually, or from the order form provided in the basic package you purchase from Radio Shack.

Standard & Poor's Corporation ✓60
25 BROADWAY, NEW YORK, NY 10004 (212) 248-3993/3374

✓See List of Advertisers on page 210

BRAINS - MAINFRAMES

SUPERBRAINS

ZENITH

SUPERBRAIN QD 64K
List $3995 only $2949

Z-89 48K
List $2895 only $2139

NORTH STARS

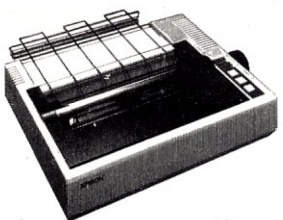
MINICOMPUTER
PERFORMANCE
GREEN PHOSPHOR
OPTIONS:
GRAPHICS + CP/M
LIST $3999
ONLY $2999

ADVANTAGE

ZENITH MONITOR GREEN PHOSPHOR $118

TERMINALS Z-19 $718

INTERTUBE III only **$725**



EPSON

MX70 GRAPHICS	394
MX80 FT	598
MX-80	474
MX-100	749

ANADEX 9501 15" WIDE PRINTER	1290
NEC LETTER QUAL FRICTION & TRAC.	CALL
DIP-81	395
DIP-84 FT GRAPHICS	595
STARWRITER LETTER QUAL FT	1824
MALIBU 200 DUAL MODE	2577
QANTEX PRINTER	1195

ATARI

400 COMPUTER	LIST 399	ONLY 340
800 COMPUTER	1080	799

WONDERFUL GAMES-EDUCATION

RCA-COSMAC VP-711 199

GAMES-BASIC-PROGRAMS-MUSIC
GUIDED SATELLITE TO SATURN

TARBELL's Empire I, II, & III have two 8" disk drives. The I is single sided, the II is double sided, and the Empire III has one of the floppies replaced by an 8-Megabyte Hard Disk. FREE BUSINESS SOFTWARE EMP 1 $4888 ONLY $3666

CALIFORNIA COMPUTER 2200A
$2195 ONLY $1795 Z80, 64K, I/O, DMA Disk controller + CP/M. Powerful & Low Price.
Model 300-1A is the larger system: 2.4 Mb 8", Z80, 64K, and optional OASIS, CP/M, or MP/M operating system. LIST $5695 ONLY $4995

MORROW DESIGNS Decision 1
features UNIX plus CP/M. Multi user & Multi processing, 4 to 6 Mhz Z80, and optional Floating Point Processor, or Hard Disk 26Mb. A very powerful system at a saving. LIST $1725 ONLY $1349

GODBOUT COMPUPRO Big 8:
6MHz Z80, DMA Disk Controller, 32K fast static RAM, Interfacer 1 I/O board, + CP/M. LIST $1995 ONLY $1595
Super Sixteen 8085/8088 is the fastest combo 8-16 CPU. LIST $3495 ONLY $2795

SYSTEMS GROUP System 2812
runs CP/M or OASIS. Supports single user & multi-user & multi task. Up to 5 megabytes with 8" drives optional 10-megabyte hard disk. LIST $5035 ONLY $3994

SEATTLE's 16 bit COMPUTER is here! 8 MHz 8086 CPU the fastest S-100 computer! 128K Static RAM, DD Disk Controller, 22-slot Main Frame, 86-DOS BASIC-86. #2 128K LIST $4185 ONLY $3349 #1 As above but 64K LIST $3190 ONLY $2649

MicroFrame—MainFrame by TEI—The perfect starting point for your Special Computer. IEEE S-100. Constant Voltage Transformer!

12-Slot	List $685	Only $614
22-Slot	825	742

COMPUPRO—Godbout 20-Slot Mainframe.

Desktop	825	674

Constant Voltage Transformer!

WE SELL GOOD HARDWARE **square** WE SELL GOOD SOFTWARE

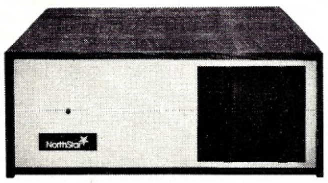
American Computers ⁄56

919-889-4577 KIVETT DR. JAMESTOWN N.C. 27282 919-883-1105

® CP/M is a registered trademark of Digital Research, Inc.

LOWEST PRICE - BEST QUALITY

NORTH STAR



North Star Horizon 2

2-5¼ Disk Drives
64K Double Den
Factory assem. & tested
Factory guaranteed
List $4195

only **$2875**

POWERFUL NORTH STAR BASIC FREE
SUPERB FOR BUSINESS & SCIENCE

FACTORY ASSEMBLED & TESTED	LIST	ONLY
HORIZON-2-32K-DOUBLE DEN	$3695	$2625
HORIZON-2-32K-QUAD DENSITY	$3995	$2799
HORIZON-2-64K-QUAD	$4495	$3150
HORIZON-1-64K-Q-HD5	$6695	$4685
HORIZON RAM ASSM	48K = $679	64K = $879
HORIZON DISK DRIVE SALE	SAVE	$445
ENGLISH TO BASIC TRANSLATOR		$99
NORTH STAR HARD DISK 18 Mb	$5375	$3889
NORTH STAR TIME SHARING MULTI-USER		CALL
ZBASIC 2 TO 5 TIMES FASTER!		$350
SECRETARY WORD PROCESSOR		$99
WORDSTAR WORD PROCESSOR		$318
FLOATING POINT BOARD	$399	$319
OASIS MULTI-USER SOFTWARE	SAVE	CALL
CP/M FOR N* Extra features	$230	$220
MICRO MIKE SOFTWARE	SAVE	CALL
MICRO DISK SYSTEM DD	$899	$799
UCSD PASCAL II.0	$199	$159
EXTRA PRECISION BASIC		$50
NORTHWORD	$399	$299
MAILMANAGER	$299	$224
INFOMANAGER	$499	$374
GENERAL LEDGER	$999	$749
ACCOUNTS RECEIVABLE	$599	$449
ACCOUNTS PAYABLE	$599	$449
INVENTORY	$999	$749
ORDER ENTRY	$999	$749

InterSystems

ITHACA INTERSYSTEMS 2A

Z-80A CPU 4 MHz
64K Dynamic RAM
Front panel
V I/O—with interrupts
FDCII Disk Controller
20 slot motherboard

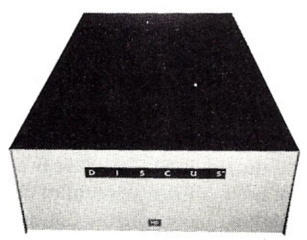
LIST $3795 ONLY $2839

PASCAL/Z + THE FASTEST PASCAL $375

	LIST	ONLY
PASCAL SYSTEM 128K 2 DRIVES	$7295	SAVE
CACHE BIOS SYSTEM 128K 2 DRIVES	$6995	CALL
CP/M SYSTEM 64K 2 DRIVES	$6295	SAVE
DPS-1 MAINFRAME WITH Z80A	$1795	CALL
Z80 MACRO ASSEMBLER	$125	SAVE
SPELL—PERFECT SPELLING	$295	CALL
COMPARE—UTILITY SOFTWARE	$295	SAVE
INTEREDIT—TEXT EDITOR	$295	CALL

MORROW 8" DISK

DISCUS 2D + CP/M® 600K ONLY $848
DISCUS 2 + 2 + CP/M® 1.2 MEGA B. $1099
ADD DRIVES 2D = $599 2 + 2 = $795
DISCUS 2D-DUAL + CP/M® ONLY $1388
FREE MICROSOFT BASIC FROM MORROW WITH DISCUS SYSTEM OR HARD DISK



MORROW HARD DISK
26,000,000 BYTES!!
LIST $4495 ONLY $3395
CP/M® IS INCLUDED!

2 QUME 2 SIDED DATATRAK 8 DRIVES IN DUAL CABINET $1640

SAVE ON MEMORY AND PROGRAMS

SYSTEMS MEMORY 64K A&T	$549	CORVUS HARD DISK	SAVE	ECOSOFT FULL ACCOUNTING	355	Which Computers are BEST?	FREE
SYSTEMS MEMORY 64K BANK	684	SSM VIDEO BRD VB3 4Mhz	412	CAT NOVATION MODEM	169	INSURED SHIPPING AT LOW RATES	
COMPUPRO 32K STATIC	347	SPECTRUM COLOR UNKIT	269	MEMORY MERCHANT 16K	159	CALL FOR LATEST PRICES, DETAILS	
ITHACA MEMORY 8/16 BIT 64K	845	EZ-CODER English to BASIC	99	WICAT 68000 16-BIT	CALL	WE BEAT ADVERTISED PRICES	

FACTORY GUARANTEES — EXPERT ADVICE

American square Computers

56

919-889-4577 KIVETT DR. JAMESTOWN N.C. 27282 919-883-1105

® CP/M is a registered trademark of Digital Research, Inc.

By Frank J. Derfler Jr.

Modems to Keep in Touch

The Gift of Communication From Hayes, Prentice

Christmas is almost here again! This month we will look at some terrific hardware and software you might want to find under your tree. We will also look at another new and interesting use of an information utility.

A Modem under the Tree?

Would you like to find a modem under your tree? Here are two that can meet anyone's needs. I really love my Hayes Stack Smartmodem! I described it in detail in the August 1981 issue, but now I have lived with it for a while and I'm still impressed. This little box (Photo 1) will autodial and auto-answer with any terminal, or any microcomputer acting as a terminal—regardless of the software the terminal has inside.

The Hayes Stack Smartmodem is an intelligent peripheral device. You send it commands over the ASCII line from the keyboard of any terminal device. When it is off-line it will respond to a command such as AT D7037341387 by dialing that telephone number with rotary dial pulses. The "AT" means "wake up, modem!" The "D" tells it to rotary dial; a "T" would set it for tone dialing. You can instruct it to wait and mix dial pulses and tone dialing to meet practically any dialing situation. When it is on-line, you simply prefix your commands with an escape code to get its attention.

The modem will auto-answer after you give it a simple command such as AT SO = 3 (answer on the third ring). It will wait for the third ring and then welcome whoever is calling with an answer tone. The speaker built into the SmartModem lets you hear the connection being made (either dialing or answering), and also operates under control of the Smartmodem software.

I'm not going to go into all of the details of how this device operates, but I will say that it should be number one on the Christmas list of anyone who uses an RS-232C port for data communications. It is a well-built, easy-to-use device with full operating capabilities. Santa would have to pay about $280 for a Smartmodem at his local computer store. The elves at Hayes Microcomputer Products, 5835 Peachtree Corners East, Norcross, GA 30092 can supply more information.

If you don't need a modem with all of those capabilities, the Prentice Star would be a nice thing to find under the tree with the toy soldiers and the dolls. The Prentice Corporation has been in the modem business for a long time, but most of their products go to the full-time heavy-duty communications market. The Star represents their new entry into the market of modems for personal or portable use. As Photo 2 shows, the Star is an acoustically-coupled device. It is well constructed, with deep cups for the telephone handset and a full complement of LEDs to show what is happening on the circuit. The switches and LEDs are conveniently placed in the front of the unit. The Star is available for under $130 from several of the advertisers in *Microcomputing*. It is a commercial-quality acoustic modem at a "hobby" price. Contact Prentice Corporation at 266 Caspian Drive, Sunnyvale, CA 94086.

The Apple II and CP/M

The CP/M operating system from Digital Research has grown in importance in the last few months. Xerox is using it in their nifty 820 system, and CP/M will be available for the IBM Personal Computer system despite IBM's acceptance of a different operating system as their standard. There are more microcomputers now running under CP/M than under any other single operating system.

It is only natural that the Apple II community would not be left behind simply because CP/M is an 8080 operating system and the Apple uses a 6502 CPU. Microsoft came to the rescue with their Softcard for the Apple II which actually gives that system an extra Z-80 CPU. With the Softcard, Apple II users can run all of the CP/M software available and still play Raster Blaster in their spare time.

As Apple II+ CP/M owners grew to know and love programs like WordStar, they needed to be able to transmit and receive their CP/M files through a modem. Several capable programs are now entering the Apple II + CP/M arena, including Crosstalk, which we discussed last month. But the first one on the market was Z-Term, written by Bill Blue.

Z-Term

Bill Blue was (along with Craig Vaughan) one of the developers of the original Apple Bulletin Board software. Bill's focus has always been on providing software with a high degree of "human engineering"; i.e., software that's easy to use. His ASCII Express package for the Apple II has long set the standard for Apple terminal software programs. Z-Term is not a warmed-over ASCII Express; it is better.

Z-Term is written in 8080 assembly language. It has the features normally found in a smart terminal program, such as the ability to transmit and receive standard ASCII text files through a buffer (38K bytes in a 56K system) and transmit prepared files in either a line-by-line or character-by-character mode in response to prompts from the other system.

The program also provides for the use of up to 12 macro files which can automatically dial a telephone number (through the Hayes Micromodem II, SmartModem, Apple Lynx or the new Radio Shack Modem II), and transmit elements of information such as sign-on codes for the system being entered. Most of these capabilities are standard with the best terminal programs, but Z-Term

also has some features found in very few other terminal packages.

Z-Term can review the buffer while on line. The only other program I know of that can do this is Omniterm for the TRS-80. The ability to look back in the buffer is valuable to people using electronic mail systems. This feature improves the quality of electronic message exchanges because it lets you look back at the messages you have received and formulate more meaningful replies. Z-Term provides very flexible use of the buffer. The buffer can be examined, cleared, saved to disk or expanded without changing the contents. This is a rare and valuable feature.

Z-Term also has some translation ability. Translation, in this case, refers to the ability of the program to change a received or transmitted ASCII character to a different character. Translation can be used to protect a printer from strange control codes, and to tailor a microcomputer to perform in certain ways.

Z-Term can tailor the Apple II to respond like a specific brand and model commercial terminal. This is particularly useful when communicating with time-sharing systems that have software written for a particular terminal.

The Z-Term manual includes information on how to tailor the cursor movement, screen blanking, reverse video and other features to match those of common commercial terminals. (These terminal emulations require that you have an 80-column display card in your Apple.)

Z-Term is flexible in the way it handles its menu. The menu usually is not displayed, so the frequent user can zip right in and out of commands with little delay. If it is needed, however, the menu can be called immediately; it provides helpful guidance in using the commands. Z-Term is one of the best available terminal programs.

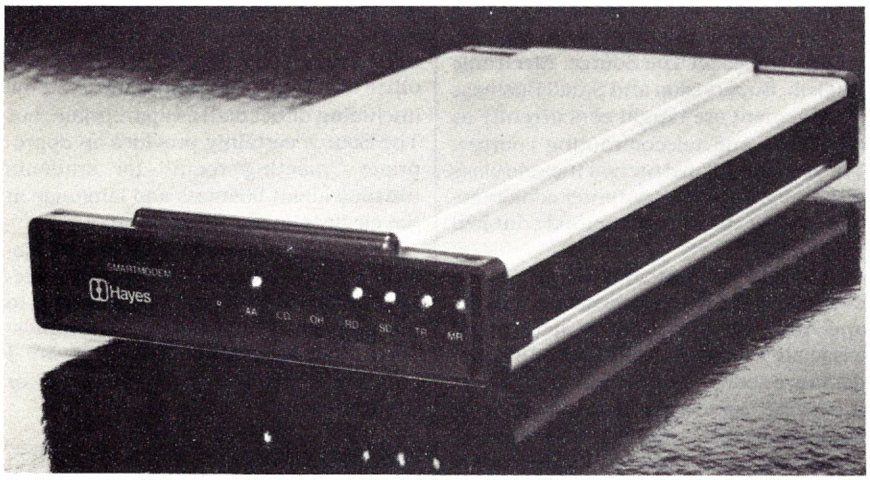


Photo 1. The Hayes Stack Smartmodem is a complete auto-answer and autodial RS-232C modem that needs no software in the terminal to operate at its full capabilities. A Z-8 microprocessor runs its own internal program which responds to commands sent over the RS-232C data line.

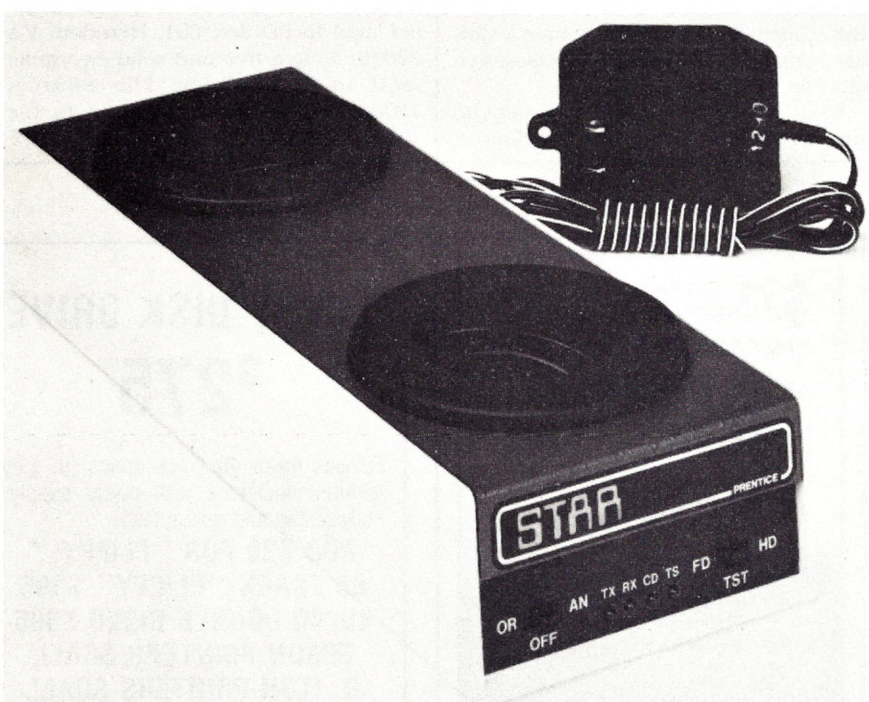


Photo 2. The Prentice Star modem is a high-quality acoustically coupled device for computers with an RS-232C port. It features switchable originate/answer and full/half-duplex operation. Various test features and a full set of diagnostic LEDs enhance its operation.

But Wait!

But Z-Term, as good as it is, now has a "big brother." Bill Blue has written an enhanced version of Z-Term called The Professional (Z-Pro). At this writing, I have not run Z-Pro long enough to award it the title of Best Terminal Package, but it's a prime contender. Z-Pro contains the protocol file transfer capability that Z-Term lacks. It also has unique handshaking macros.

Protocol Transfer

People seem to have taken two separate paths in their use of microcomputers as data communications devices. One type of system (generally non-CP/M) is used mainly for electronic mail functions and bulletin boards. Another type of system (usually running under CP/M) concentrates on file transfer protocols needed to exchange programs and databases.

Several handshaking protocols have been developed to ensure the accurate transfer of data. The protocols in use include the cyclic redundancy check (CRC) and the Christensen protocol (created by Ward Christensen, one of the CBBS developers). Some programs, such as ST80-III, written by Lance Micklus, take the middle course—they check the transmitted data against the received echo and warn of errors. But most *terminal* programs ignore error detection and correction.

Z-Pro seems to span both camps. It has the prompted file transmission common in terminal programs and the error detection and correction found in the dedicated file transfer programs. Z-Pro will also support the PAN electronic mail format. (See last month's column for a brief discussion of PAN.)

Z-Pro also has something completely new: interactive macros. Most macro files (including those in Z-Term) are simply files of data that are prestored and transmitted out of the modem port at the appropriate time. The first bytes often cause a modem to dial a number, and the remaining bytes may transmit a sign-on or directive code, but the timing of most

systems makes it nearly impossible to get dialed in and signed on with one keystroke. The macro is really sending blind unless you direct the transmissions at every appropriate time.

The macros in Z-Pro are actually miniprograms. Once you get them set for your needs, you can initiate the macro and walk away. The system can dial the number, sign on to a carrier like GTE Telenet, request an information utility like The Source, sign on to the utility, refuse the bulletins, refuse Chat and check your mail while you are making your first cup of coffee. It can do this despite the irregular system response times that fool every other smart terminal program.

All that power might make you think, "It should be easy to tie in the macro activation with a clock card and eliminate the need for the human element. The system could sign on during the lowest rate period, receive mail, dump prestored mail and sign-off automatically. The user would be cut loose from one bond of the time tyranny of telecommunications." When are you going to go the final inch, Bill?

Z-Pro has a lot of other features, including a buffer for the printer and the ability to exchange data at 1200 bits per second (using an appropriate modem). It can be fully integrated with the powerful Apple Cat II, and can make use of that device's Baudot/Murray code capabilities.

Cost and Requirements

Both Z-Term and Z-Pro require an Apple II with the Microsoft Softcard, CP/M and at least 44K bytes of RAM. They can support various integrated modems and communications cards. They also get along fine with lowercase adapters and 80-column display boards. They are available from Southwestern Data Systems, 10159-G Mission Gorge Road, Santee, CA 92071. Z-Term costs $99 and Z-Pro is $149.

With The Utilities

Stroke for stroke, The Source and CompuServe are still giving the spectators a good race. CompuServe continues to improve its Consumer Information Service with some really useful special-interest groups and unique bulletin boards. The Source, however, has come up with yet another way to attract the attention of the crowd.

College via Computer

On October 5, Colorado Technical College began offering three college-credit courses on The Source. Electronic English, Supervision and Small Business Management are taught concurrently as classroom and telecommuting courses. The methods of instruction include class discussion, reports, computer conferencing and a teaching method dubbed "electure."

Colorado Technical College is accredited by the North Central Association and ABET. It offers both bachelor's and associate's degrees. Telecommuting students are accepted into the courses under the same admission policies as local students. Telecommuting students must be on line for at least two of the eleven classes for a minimum of one hour.

The Chat mode of The Source is used to link the telecommuting students with the class and instructor in Colorado during these synchronous sessions. The rest of the assignments, discussions and lectures can be done at times convenient to the student by using The Source's storage capability to bring the classroom alive for the student.

Each course requires the student to turn in written reports over The Source. The tuition is $210 per course, but this does not include your on-line charges. At $4.25 a connect hour (assuming no long-distance calls are needed to enter The Source), the Source usage charges will run between $45 and $75 per course. This may seem high at first, but consider the cost of the gas needed to commute to your local school over a semester and the freedom this method of education gives you in setting your own time. You may find these novel courses to be a bargain. Other course offerings will be coming soon.

I should add that The Source has no tie with Colorado Technical College. Professor David R. Hughes is pioneering this use of a new medium for formal education. The college might decide to use other electronic transmission systems (including direct dial) as appropriate, but The Source certainly provides an appropriate "meeting room" for students learning about business and language in the electronic-information age.

If you are interested, contact the Colorado Technical College placement director at 303-598-0200. I will be watching to see whether this use of data communications systems grows. Who knows? I might be good for a guest "electure" or two myself.

Tell me!

If you intend to start the new year by marketing equipment or programs for communicating microcomputers, let me know. If you have any specific questions about communicating-microcomputer systems, ask me, but please include a stamped envelope for the reply. Send paper mail to PO Box 691, Herndon, VA 22070. Save a tree and send electronic mail to TCB967 on The Source, 70003,455 on CompuServe or to the AMRAD CBBS, 703-734-1387.□

THE WORLD IS YOURS

Data communications can open up a whole new world to you and your computer. A world of the future. Now. A world full of information resources, time-sharing computer systems, and electronic "bulletin boards." All you need for admission to this world is your CP/M®-based computer, a modem, and the proper software. That's where we come in. We have the proper software. CROSSTALK,™ our smart terminal & file transfer program for CP/M, allows you to call into thousands of dial-up computer systems around the world, and communicate with them. REMOTE, our CP/M remote console program, allows you to operate your CP/M system from a remote terminal, giving your computer added flexibility and usefulness.

CROSSTALK

- Allows your computer and modem to communicate with other computers, including other **CROSSTALK** systems, public-access "bulletin board" systems, main frame computers, subscription "Information utilities" such as THE SOURCE,™ and much more.
- Simple, easy to use "plain English" command structure makes **CROSSTALK** easy to learn, yet provides a powerful tool for exchanging files, capturing data, and controlling modem parameters.
- Concurrent printer and video allows you to print data while viewing it on the CRT.
- Fully error-checked file transfers using 16 bit CRC protocol. Protocol transfers allow exchanging files which are larger than the system's memory.
- Built in "DIR" command.
- Data capture allows saving received data onto your disk.
- Auto-dial, redial, and auto-answer (if supported by modem).

Available for the following modems: Hayes 80-103a
Hayes Smartmodem™
Hayes Micromodem 100™
PMMI Communications MM-103
Hayes Micromodem II™ for the Apple II®
Any RS-232 modem, including 1200 baud modems

REMOTE

- Allows **remote** use of your computer from a **remote** terminal location.
- May be called as a subroutine from BASIC, PASCAL, or any other program to allow answering under program control.
- Provides nulls if needed for printing terminals.
- Uses less than 1k of memory space.
- Automatically selects proper baud rate.
- Available for S-100 modems (Hayes and PMMI) only.

For details, see your computer retailer, or contact us directly.

MICROSTUF™

Microstuf, Inc. ✓253
1900 Leland Drive, Suite 12
Marietta, Georgia 30067
(404) 952-0267

Smartmodem™ and Micromodem™ are trademarks of Hayes Microcomputer Products, Inc. / Apple is a registered trademark of Apple Computers, Inc. CROSSTALK is a trademark of Microstuf, Inc. / CP/M is a registered trademark of Digital Research Inc.

DEALER INQUIRIES WELCOME.

COMPUTER BLACKBOARD

By Walter Koetke

The Value Of Models

Aids in Solving Problems

Mathematical Models

You are already familiar with many different types of models—model airplanes, model ships, model cars, doll houses, or even dolls themselves. One model is usually called "better" than another if it is more realistic. For example, toy dolls, which are intended to be models of real people, are made to walk, to blink their eyes, to have real hair, and to have many other properties of the people they represent.

All models, however, are not just toys. Scientists, engineers and mathematicians try to model all aspects of space travel before a rocket is launched. If a model spacecraft is found to be unsafe before the actual spacecraft is built, then not only money and time, but human lives can also be saved. Political candidates and the news media try to model the voting patterns of people so they can predict the winners of important elections. The design of a new airplane, the results of rapid population growth, the durability of a new product, the widespread effects of building a new dam, and many other very complex problems are modeled by very serious people with very elaborate equipment.

With the assistance of the rapid computation speed available on modern computers, the usefulness and accuracy of models has increased sharply. Many modern models are mathematical models. A mathematical model for the design of a new airplane wing does not look very much like an airplane wing, but consists of a series of expressions and equations that represents the new wing. The model also represents the many different factors such as air pressure, air speed, temperature and altitude that can affect the wing's performance. With the aid of the computer, a mathematical model can simulate the behavior of the new wing under many different operating conditions. After the mathematical model indicates that the new wing design is acceptable, then a more conventional model that looks like a wing can be constructed and tested in a wind tunnel.

In other applications mathematical models can simulate relationships that are impractical or impossible to simulate with physical models. The long-term effects of several different techniques for treating a polluted river cannot be reliably simulated with a physical model. However, very realistic mathematical models can be constructed. First the mathematical models indicate the most effective treatment. Then the actual stream can be economically treated using the technique that has already been proven successful in model form.

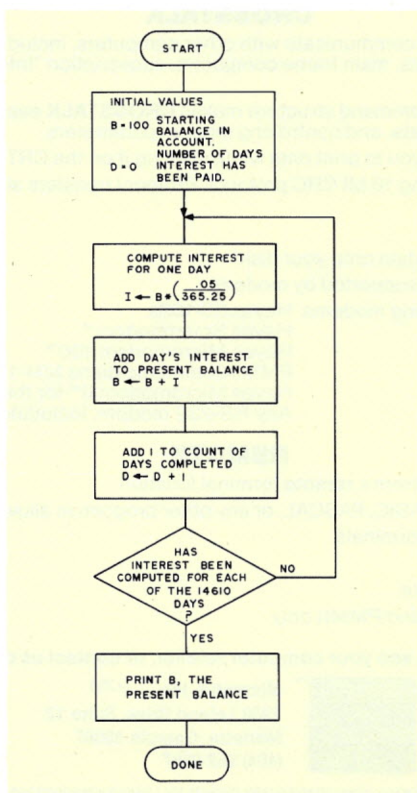


Fig. 1. Algorithm to determine the balance in a savings account.

Let's examine what appears to be a simple but useful mathematical model. Suppose that while cleaning the garage, Dave's mother finds a bank book in an old suitcase. The book shows that a single deposit of one hundred dollars was made in a local bank on April 1, 1941. The book was probably then lost, since there are no other entries. The account indicates that the bank pays an annual interest rate of 5 percent, which is compounded daily and added to the account quarterly on January 1, April 1, July 1 and October 1 each year.

Dave is anxious to take the book to the bank to discover how much money the account now contains. Since today is April 1, 1981, exactly 40 years' worth of interest should be added. However, since today is also Sunday and he must go to school next week, his curiosity may not be satisfied before next Saturday.

Fortunately, his problem can be solved with the help of a mathematical model and the computer facilities at his school. The total balance of any savings account (started with A dollars, to which an annual interest rate of P percent is compounded T times per year for Y years) can be obtained using the expression:

$$A\left(1+\frac{P/100}{T}\right)^{Y\cdot T}$$

Since Dave knows the value of each variable:

A = 100 dollars
P = 5 percent
T = 365.25 days per year
Y = 40 years

the expression can be used to determine the current balance of the old savings account. By substituting these numerical values into the expression, he obtains:

$$100\left(1+\frac{5/100}{365.25}\right)^{40\cdot 365.25}$$

which can be written as:

$$100\left(1+\frac{.05}{365.25}\right)^{14610}$$

This expression, evaluated using a calculator or the very short BASIC program:

```
10 PRINT 100*(1+.05/365.25)↑14610
20 END
```

represents a balance of $738.28. The expression A(1+(P/100)÷T)↑(Y*T) is a mathematical model that can be used to determine the balance in a savings account without using any money, without consulting a bank, without waiting for several years to elapse, and without even having a savings account.

Another model for computing this same balance, and one that does not depend upon knowing a special expression, is the algorithm shown in Fig. 1. This algorithm is represented by the BASIC program:

```
10 LET B=100
20 LET D=0
30 LET I=B*(.05/365.25)
40 LET B=B+I
50 LET D=D+1
60 IF D<=14610 THEN 30
70 PRINT B
80 END
```

The balance output by a run of this program is $738.905. Unfortunately, Dave is confused because these two models do not yield the same balance. To make matters worse, his mother went to the bank, which computed the current balance of this account as $738.88. Why did the models indicate balances of $738.28 and $738.905, when the correct balance is $738.88? Since the better model is the more realistic one, Dave is anxious to learn why neither model gave the exact answer. His mother observed the following ideas that were not correctly simulated by Dave's model.

1. The number of days in a year is not 365.25, but exactly 365 days except during leap years. During leap years there are exactly 366 days. This means that the daily interest payment should be B*(.05/365) or B*(.05/366) depending on the year. During the years 1933 through 1973 there were ten leap years—1936, 1940, 1944 and every fourth year thereafter.

2. The bank adds interest payments to the account four times each year. The balance is always rounded to the nearest cent when the interest is paid. The balance is not rounded to the nearest cent in either of the two models.

A mathematical model that includes these two ideas would be more complicated, but would yield the correct balance. In fact, most banks use computers and similar mathematical models to compute the current balance of all accounts. Whenever a mathematical model is created, you must exercise extreme care to make the results as accurate as possible. If the model is not 100 percent accurate, the percent error of the model should be calculated.

Dave's mother was also concerned about another question, but she wasn't sure how to explain the problem to him. After he had initially obtained two different answers on his TRS-80, his mother asked her friend to do both computations on her Apple. Unfortunately, the Apple produced 738.80 and 738.905, respectively. When she then tried to use the PDP 11/70 at the local college, she was confidently given yet a third pair of answers, 738.47 and 738.905. She was confused as to why three different computers would calculate three different values for the same mathematical expression. An explanation of this will be the subject of a future column. For the moment, however, be advised that you should not assign a programming problem to students without first attempting to solve that problem. And you must never label a student's answer incorrect without considering the possibility of computational error that the student was not prepared to anticipate.

Homework Assignments

As promised last month, let's now examine a few problems appropriate for student solution with computer support. None requires any more mathematical background than a few months of algebra.

1. Doris is studying the population growth of a certain type of fly in her biology class. She begins her experiment with ten flies, and has predicted the following pattern to the population growth:

- Each month, every pair of flies can produce exactly ten new pairs of flies.
- After producing their offspring, the parent flies always die.
- Twenty percent of the pairs of flies born each month will die without reproducing.

A. If Doris conducts her experiment for the entire ten-month school year, exactly how many flies will be alive when she finishes her work?

B. Write a program that will allow a user to enter the number of flies at the beginning of the experiment and the number of months that the experiment will last. The program should then calculate and display the approximate number of flies expected to be alive when the experiment concludes.

Notice that this problem can be solved without any flies and without waiting ten months. The problem should be solved by creating a mathematical model that simulates the fly population.

2. A program that models the Gregorian calendar can be both fun and interesting. Although the Gregorian calendar is very accurate—an error of only one day in 3320 years—it is only based on a few simple facts.

- There are 30 days during April, June, September and November; 28 days during February except in leap year when there are 29; and 31 days in all other months.
- Leap years are those years that are divisible by 4 but not by 100 or are divisible by 400.
- January 1, 1800, was a Wednesday.
- The calendar will repeat every 400 years.

Using these facts you can write programs that: print a calendar for any given year; determine on which day of the week a particular date did or will occur; or print any information that can be determined by looking at calendars. For a specific task, write a program that will permit a user to enter the month, day and year of any date after January 1, 1800. The program should then print the day of the week that corresponds to the given date. The output from a run of your program might appear as:

```
RUN
? 10, 2, 1939 represents October 2, 1939
 MONDAY
```

3. Suppose you are a baseball manager in the unhappy situation of having an entire team with individual batting averages of .220. To make matters worse, when a player gets a hit there is only a one-tenth chance that the hit is a double rather than a single. What is the average number of runs your team will score in a nine inning game? Assume that a single will advance each runner one base while a double advances each runner two bases.

After answering this question you may be interested in expanding your program so the nine different batting averages of an entire team can be entered. By doing this and running several simulations, you can discover the most effective batting order. When properly used, computers can make positive contributions in some unexpected areas. What other functions of a baseball manager might a computer assist?

4. Suppose you must cross a 1200 mile desert in your jeep. The gas tank holds 30 gallons and you are confident of obtaining 15 miles per gallon. At your home on one side of the desert you can obtain all of the gasoline you require. What is the minimum number of gallons required to cross the desert? No, the answer is not that you can't go further than 450 miles, nor is the answer a trick. If you need help, consider the methods used to climb Mt. Everest.

Mathematical models and simulations are playing an ever-increasing role in our lives. Providing students with the background and facilities for creating their own models should be an integral part of today's science and mathematics classes. □

> Let's now examine a few problems appropriate for student solution with computer support.

Compiled by Eric Maloney

Put on Your Running Shoes

Nike Lab Uses Micros For Research

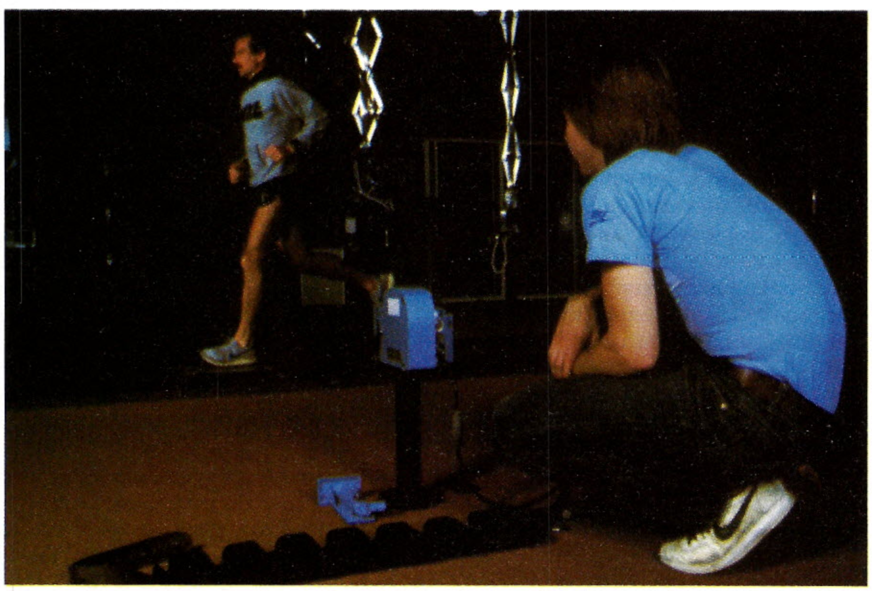
Nike Goes Micro

The treadmill rotates tirelessly as the runner strides on its platform, running hard but never moving ahead. Off to the side, two men sit in front of a tangle of machinery, looking at dials, screens and only occasionally at the lonely runner himself. One of the men turns a dial and the platform of the treadmill angles upward ever so slightly. The runner suddenly finds himself moving backward and must increase his efforts to stay in place—at the cost of a greater expenditure of energy.

Soon, the runner, breathing into a plastic mask connected to a flexible tube, begins to falter and, with a wave of his left hand, signals that he has had enough. The treadmill slows to a halt. The second man types a few keystrokes into an Apple microcomputer and reports, "In a minute we'll know your VO_2."

These men, exercise physiologist Jack Daniels and technician Jamie Larsen, work for Nike Corp., one of the world's largest manufacturers of shoes for runners. The tests they perform on the runners who visit the Nike Reasearch and Development facility in Exeter, NH, are helping them amass data to better understand the dynamics of endurance exercise and running efficiency. To help in these tasks, Nike uses an Apple microcomputer.

The Biomechanics Lab, under the direction of E.C. (Ned) Frederick, originally acquired its Apple as a backup to its Digital Equipment Corporation PDP-11/34 minicomputer—the Apple can easily communicate with its larger brother. The Lab was also looking for a portable device. Daniels and Frederick plan to use the Apple in outdoor running tests designed to measure important physiological factors under real conditions. Since the computer was obtained, the personnel at Nike have found an increasing number of ways to use it.



An Apple plays a key role in the Nike lab.

Running Efficiency

The Apple's principal role at present is to monitor the tests of running efficiency performed by Daniels and Larsen. These tests, conducted on the treadmill, measure efficiency by analyzing the gases exhaled by the athlete while he runs. His exhalations are trapped by a mask on his face, and fed into an oxygen analyzer and a Beckman carbon dioxide analyzer. These devices are connected electronically to an analog-to-digital converter, then a controller and finally to the Apple computer via its RS-232 interface.

Using a program called Classical Gas, the Apple calculates the ratio of oxygen to carbon dioxide in the runner's exhalation and compares these figures to the quantities of these gases in the free air. It then calculates how much oxygen the runner is using. Its calculations are displayed in milliliters of oxygen per kilogram of body weight per minute.

When a runner is forced to cross over from aerobic (with oxygen) to anaerobic (in the absence of oxygen) modes of burning energy, increasing amounts of oxygen do not produce greater energy. It is at this point that the runner reaches his maximal oxygen uptake, or VO_2 max. For an endurance athlete like a runner, this is his highest level of efficiency.

The Classical Gas program, written in BASIC by Jamie Larsen, is just one of several that the Nike Lab has produced. Another program, called Fat Factor, calculates from height and weight a relative measure of an athlete's ideal weight range. IMP is a statistical model that simulates the effect that weight, height and running speed have on impact forces. Race Organization is a program under development to help score cross-country races and print out results. Impact Library is a data file on the variety of materials used in Nike shoes, storing information on rebound time, compaction characteristics, energy loss and other factors.

All work makes for dull guys so the boys in the lab have come up with Race

Invaders, a game for athletes (still under wraps in a dark corner of the lab).

Undoubtedly, however, the lab's most famous program is its Performance Predictor. This program estimates from previous race times a time for any other distance. Nike used the program at the 1981 Boston and New York marathons to predict the times of hundreds of runners. In Boston, the program predicted winner Toshihiko Seko's time within 20 seconds. For most other runners in the race, predictions were within two minutes, even for finishers in the four-hour range. Many runners wrote to Nike after the event to report their time—and many apologized for not finishing in the time predicted!

Manufacturing and the Apple

The Nike Lab has passed the word to the rest of the company that a versatile microcomputer is a valuable tool. The company is now developing programs to analyze the data collected in its wear-testing project. This project is designed to help Nike evaluate the comfort and wearability of its new prototype shoes, using over 2000 volunteer runners around the country. The research and development facility plans to use an Apple to track the progress of its prototypes through the manufacturing process, including keeping track of inventory. The marketing division feeds data from surveys of preferred colors, customer surveys and biomechanical questionnaire results to Exeter and the Apple is used to analyze and organize the statistics that result.

All this information guzzling goes into the production of shoes that can theoretically improve performance. Nike now offers 35 different models of running shoes, many designed for specific classes of runners.

Even though the search for new knowledge about the physiology of running continues, Ned Frederick cautions: "We are at about the same stage that the American auto industry was in the early 1950s. We're just beginning to perceive just how much we don't yet know."

With an Apple at its core, the search goes on.

G. Michael Vose
***Microcomputing* staff**

English Computing Show Draws 16,000

The rush to personal computing is on in England, as shown by a turnout of 16,440 persons for the fourth annual Personal Computer World Show, Sept. 10–12 in the Cunard Hotel, London.

Compare that kind of response with the 30,000 who attended the seventh Computer Faire last April in San Francisco, the heart of the world computer community, and you get some idea of just how interested the British have become in personal computing.

Three key factors are at work:

- The availability of cheap, useful machines such as the Sinclair ZX-80 and ZX-81 and the Acorn Atom, all of which offer true (if limited) computing for less than $300.
- The British Broadcasting Company's upcoming computer literacy series, complete with tutorials based on a special BBC Microcomputer, which was on display at the show.
- The Prestel home television/computer system, which, while still beyond the economics of most English families, has created large awareness and intense interest in individual interaction with personal computers.

The organizers of the PCW show, sponsored by England's largest computing magazine, had given much attention to organization, but even they didn't expect the turnout that saw a quarter-mile long line awaiting admission the first day. The show occupied two exhibition floors of the Cunard—with recreational exhibitors on the lower floor and business hardware and software on the upper level.

> No one expected the turnout that saw a quarter-mile long line waiting the first day.

Represented among the almost 100 exhibitors were user groups, hardware manufacturers, software publishers, magazines and even an instant copying stand, kept busy churning out photo reproductions of manuals purchased by one visitor who just wanted the extra copies for "backup."

Among the busiest stands was the Tandy booth, which dominated the upper level, with its full range of demo TRS-80s. In an England sorely pressed by a soft economy and high inflation rates, the Tandy machine may be the top of the line—along with Commodore ("Don't call it PET. We've outgrown that image!") and Apple.

Clive Sinclair, who stirred things up last year with his ZX-80 (50,000 units sold at $200 each), was back with the ZX-81. Priced even lower than the first generation, at about $100 for a kit version or $150 assembled, the ZX-81 uses only four chips, has an 8K BASIC ROM and is expandable with 16K plug-in RAM pack.

Another low-end piece of hardware on display was the Acorn Atom, available in kit for about $200, and assembled for about $270. The bare-bones Atom, using a 6502 CPU and offering a 16 by 32 video diplay, features 8K of ROM and 2K of RAM. It has its own peculiar AtomBasic, which does not allow READ. . . DATA operations, which offers two bewildering PRINT statements, and which precedes string handling operations with the $. The Atom was designed to be expanded, and offers such upgrades as 1K RAM sets at $15 each, a 4K floating point ROM at $35, printer driver at $25 and color encoder and buffer at $36.

The Atom was selected by BBC as the mode for its Microcomputer, much to the chagrin of Sinclair, who grumped at the time: "What the BBC is doing, it is doing badly."

The BBC micro, slightly more expensive than the Atom, seems to be a lot of machine. It has a 73-key QWERTY full-travel keyboard and 16K of ROM, uses Microsoft BASIC, has 32 × 40 or 25 × 40 video output and supports color graphics up to 320 by 256 on a standard European PAL system television receiver. In addition, the Model B, the top of the line, offers 32K of RAM, 640 by 256 color graphics, a Centronics-type parallel printer port, a RS-423 serial interface compatible with the RS-232C and the ability to network with up to 255 other users.

Another machine unfamiliar to the States worth mentioning is the DAI personal computer, from Data Applications International of Brussels. It was born under a development agreement with TI. TI then walked away from it and Data International, whose main business is industrial controls, was left wondering what to do with a high-performance color and sound generating machine that could be sold for around $1100. They figured it out.

The machine is based on the 8080A microprocessor and is available with up to 48K of RAM, plus 24K of bank switched ROM that contains the resident software and a BASIC interpreter that emulates Microsoft, monitor and other housekeeping functions. Housed in an integral full-travel keyboard, the machine features 16-color, 256 by 336 high-resolution graphics, stereographic sound generation, and plugs for everything except your electric shaver. The interfaces include game paddle sockets, dual cassette input, and RS-232C and DCEbus interfaces.

If there was a noticeable shortcoming in the show, and perhaps in British personal computing as a whole, it was in the area of software. One dealer explained: "It seems that we have to import it all, either from the States or the Continent, and then translate it. You Yanks don't even know how to spell programme."

As might be expected, most of the software on display was aimed at the small machines mentioned above. The business software was largely Apple and Tandy, with only a few offerings in CP/M and

other larger-system formats.

One of the major such offerings was Silicon Office, billed as a complete office management system—word processing, payroll, financial, etc.—one package. The problem, according to a competitor, is that it is "designed for a machine that doesn't yet exist (the Commodore 9602)."

The second major piece of software, which drew large crowds to its Tandy-machine demonstration area, was The Last One, a code-generator first introduced in San Francisco in April and which has been supported by what is believed to be a million-dollar advertising budget. Michael Falter, vice-president of marketing for DJ "AI" Systems, Inc., the publisher, would not deny nor confirm the published report that about $9 million in orders have been taken for the program, which was expected to be shipped in October.

The user groups and club displays were constantly active signing new members. The magazine publisher booths sold briskly. (Tip to show-goers: Wait till late afternoon of the last day. You can get two, three or four for the price of one. No publisher wants to carry all those back issues home again.)

The second annual Microcomputer Chess Championship was won by a homebrew program that brushed aside all five of its opponents in the 12-entry field, which included such popular and well-known systems as Gambiet 81, Philidor and Chess Champion Mark V.

Richard Lang, who wrote Cyrus in about six months of spare time, is a 26-year-old research programmer for the English natural gas utility. His winning program, written in Z-80 assembler language, occupies just over 7K of memory and includes an opening book table of 1.25K which "I took straight out of the Penguin paperback of chess openings."

According to Michael Stean, an international master, the program is particularly exciting in its ability to mount powerful coordinated attacks using numerous pieces, without the emphasis on the queen shown by many programs. Cyrus's end-play capabilities are a matter of conjecture, however; Lang noted, "He usually doesn't get that far before winning." All five games in the tournament were won in the middle game.

When last seen, Lang was fending off potential marketers, and saying, "Version 2, which is almost finished, will be considerably stronger."

As the show wound down on a glorious fall Saturday afternoon, David Tebbutt, former editor of PCW and now President of Caxton Software, Ltd., and the man who spurred these first four PCW shows, said: "It looks like they'll be seeking much bigger space next year."

And who knows what Sinclair will be offering then?

By Edgar F. Coudal
Special to *Microcomputing*

RFI Regs Defeat Compucolor II

The Federal Communications Commission's new radio frequency interference regulations have claimed at least one victim in the microcomputer world.

Intelligent Systems Corp. has decided to pull its Compucolor II from the U.S. market. The reason: changes required to meet the FCC's class B standards would cost too much money.

"The Compucolor II was not especially profitable for us to begin with," says Susan Sheridan, ISC's manager of marketing communications. "When the FCC came up with its ruling, we looked into what changes would be required, and decided that it would cost too much in money and resources."

Sheridan says that the necessary changes were probably no more involved than those made by Apple or other companies. But, she adds, Apple's Apple II was making too much money to be pulled from the market. The Compucolor II has not brought in enough revenue to make the investment worthwhile.

Much of the problem lay with a lack of manpower, Sheridan says.

"For example, we would have had to change the analog board," she says. "At the time, we were designing a new analog board for our other computers, and it would have meant pulling one of our engineers from that project."

Also, says Sheridan, ISC has a computer in its Intecolor series which is in a price range to be used as a home computer.

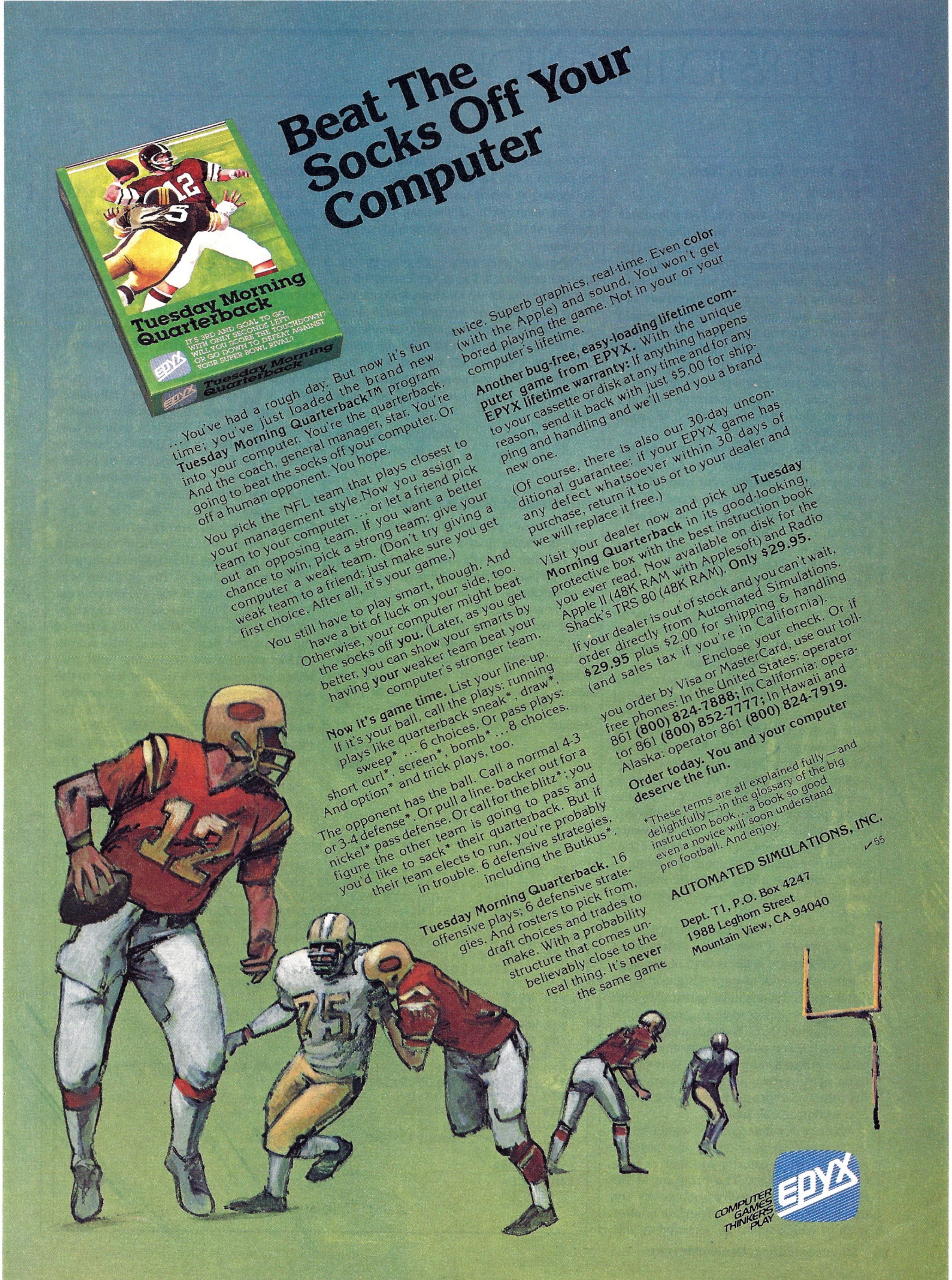
The Compucolor II is based on the 8080A microprocessor, and includes 8K, 16K or 32K byte models. Its base price is $1895-$2495, and is targeted for the home and school market.

Although the micro will no longer be sold in the U.S., the company has promised to maintain customer support. It will still publish *Colorcue*, a bimonthly magazine for Compucolor and Intecolor owners, and provide parts and repair.

ISC will continue to market the Compucolor II in Europe.

The FCC regulations require that Class B computing devices—those intended for home use—meet stringent regulations to control potential interference with other electronic and communications devices. The major micro manufacturers—including Apple, Radio Shack, Ohio Scientific, Commodore and Atari—have received certification for their micros.

A complete story on the new regulations appeared in *Microcomputing*'s April issue ("FCC Takes Aim Against RFI Polluters," p. 30).□



Beat The Socks Off Your Computer
Tuesday Morning Quarterback
IT'S 3RD AND GOAL TO GO WITH ONLY SECONDS LEFT! WILL YOU SCORE THE TOUCHDOWN? OR GO DOWN TO DEFEAT AGAINST YOUR SUPER BOWL RIVAL?
EPYX
Tuesday Morning Quarterback
EPYX
...You've had a rough day. But now it's fun time; you've just loaded the brand new **Tuesday Morning Quarterback™** program into your computer. You're the quarterback. And the coach, general manager, star. You're going to beat the socks off your computer. Or off a human opponent. You hope.
You pick the NFL team that plays closest to your management style. Now you assign a team to your computer ... or let a friend pick out an opposing team. If you want a better chance to win, pick a strong team; give your computer a weak team. (Don't try giving a weak team to a friend; just make sure you get first choice. After all, it's your game.)
You still have to play smart, though. And have a bit of luck on your side, too. Otherwise, your computer might beat the socks off **you.** (Later, as you get better, you can show your smarts by having **your** weaker team beat your computer's stronger team.
Now it's game time. List your line-up. If it's your ball, call the plays: running plays like quarterback sneak*, draw*, sweep* ... 6 choices. Or pass plays: short curl*, screen*, bomb* ...8 choices. And option* and trick plays, too.
The opponent has the ball. Call a normal 4-3 or 3-4 defense*. Or pull a line- backer out for a nickel* pass defense. Or call for the blitz*; you figure the other team is going to pass and you'd like to sack* their quarterback. But if their team elects to run, you're probably in trouble. 6 defensive strategies, including the Butkus*.
Tuesday Morning Quarterback. 16 offensive plays; 6 defensive strategies. And rosters to pick from, draft choices and trades to make. With a probability structure that comes unbelievably close to the real thing. It's **never** the same game twice. Superb graphics, real-time. Even **color** (with the Apple) and sound. You won't get bored playing the game. Not in your or your computer's lifetime.
Another bug-free, easy-loading lifetime computer game from EPYX. With the unique **EPYX lifetime warranty:** If anything happens to your cassette or disk at any time and for any reason, send it back with just $5.00 for shipping and handling and we'll send you a brand new one.
(Of course, there is also our 30-day unconditional guarantee: if your EPYX game has any defect whatsoever within 30 days of purchase, return it to us or to your dealer and we will replace it free.)
Visit your dealer now and pick up **Tuesday Morning Quarterback** in its good-looking, protective box with the best instruction book you ever read. Now available on disk for the Apple II (48K RAM with Applesoft) and Radio Shack's TRS 80 (48K RAM). **Only $29.95.**
If your dealer is out of stock and you can't wait, order directly from Automated Simulations. **$29.95** plus $2.00 for shipping & handling (and sales tax if you're in California). Enclose your check. Or if you order by Visa or MasterCard, use our toll-free phones: In the United States: operator 861 **(800) 824-7888;** In California: operator 861 **(800) 852-7777;** In Hawaii and Alaska: operator 861 **(800) 824-7919.**
Order today. You and your computer deserve the fun.
*These terms are all explained fully—and delightfully—in the glossary of the big instruction book...a book so good even a novice will soon understand pro football. And enjoy.
AUTOMATED SIMULATIONS, INC.
✓55
Dept. T1, P.O. Box 4247
1988 Leghorn Street
Mountain View, CA 94040
12
75
COMPUTER GAMES THINKERS PLAY
EPYX

LETTERS TO THE EDITOR

You Have Won A New Ferrari!

In your Sept. issue you had a fascinating piece on instant mail (Publisher's Remarks, p.6). The article touches on the fly in the ointment of instant mail—the junk mail problem. Can you imagine the benefit to the direct mail advertiser of a message that must be at least partially scanned? Currently you can pretty well tell if a letter is junk mail and trash it unread or at least defer it. With the use of electronic mail you will need to read at least part of it to determine content, and at that the probability of sales multiplies.

Please do not interpret this as nit-picking. It's merely that I can see logging on my home terminal and immediately getting a raft of messages—most of them to the effect that I have won a Ferrari, a Cessna, a new home or a solid walnut toothpick if I will visit some dumb development. Since buried in this mass of mail may be a letter informing me the city has tripled my property taxes, or I have inherited controlling interest in a major oil company, none of the mail can be ignored, so I will be stuck with reading at least some part of each piece.

The economics for the personal or business mailer would have the advantage of finer demographic targeting with area-code-prefix coding. They would be able to buy a couple of WATS lines, program their computers to dial the selected area and prefix and deposit their message in every mailbox for that prefix. With the development of standard protocols and low-cost fax equipment, the transmission of pictures, graphs and other brochure equivalents, perhaps even in color, could go along with the mail. All designed to capture the attention of the reader.

The avoidance of this corruption of what is really a potentially outstanding tool will require a great deal of thought. Such techniques as capturing and passing through the originating number with the receiver being able to program his site to ignore WATS originated entries are possible but would compromise some of the system's value. I would hold out no hope of governmental regulation since the direct mail people have such a strong and well-financed lobby.

Another possible control would be for the subject to provide all the possible mailers with a priority number or code controlled by him. The program at the terminal would scan for such codes and direct the mail to the appropriate bucket, each of which could be scanned at will. Those pieces not having a priority would be put in a file 13 equivalent that would be looked at when nothing else is going on (or dumped). Obviously creditors would not be given one of the high priority codes.

As an old-timer (nearly 25 years) in the use of computers, I long ago learned that very little comes up as clean and uncluttered as initially envisioned. However, as an old-timer I have long since learned not to put any limit on what can be done. Therefore I am in full accord with you that direct mail will be accomplished and indeed look forward to seeing how it is done.

Richard J. Kelley
Sapulpa, OK

Electronic Mailbox Now

Mr. Green's plea for an electronic mailbox in September's "Publisher's Remarks" has already been answered, at least in part. British Telecom has even implemented the encoded dictionary that he envisioned.

For background information: Prestel adapters cost about $260 and up. TVs with adapters are available from rental companies. A local telephone call is about 7 cents for two minutes at peak time, falling to seven cents for 12 minutes from 6 PM to 8 AM.

R. Larkin
London, England

Speed Up FILEMAP

I was very excited about the FILEMAP program found in your September 1980 issue ("FILEMAP," by Douglas L. Jones, p.166) because many of my programs are in excess of 17K and there are hassles involved in hunting down variables whenever extensive changes must be made.

Therefore, I entered this program onto my system for a try. I found somewhat to my disappointment that the program is slow.

After close examination of the program, it appeared subroutine 1100–1120 could be speeded up. The main problem as I saw it was the RESTORE usage and the serial search for the BASIC command string. From the typical list of BASIC commands one can find a reasonable alphabetical distribution of them.

The task was easy. Read in all the BASIC commands into an array. Set up a second array containing the alphabetical pointers (see lines 185–195 in Listing 1).

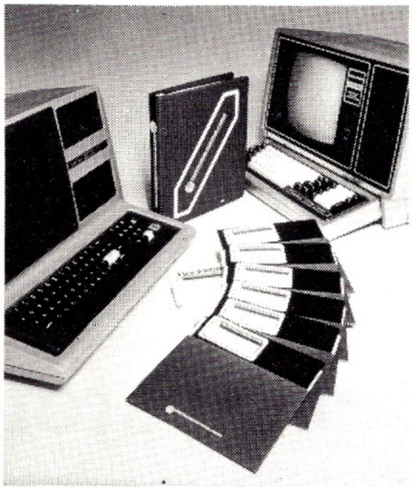
The second half of the problem was adapting this approach to subroutine 1100–1120. This subroutine improvement simply checked the first letter of the string and then would serially search BASIC commands beginning with that letter. For example, if the first letter of the string SS$ was O then the subroutine would compare OCT$, ON, OPEN, OR and OUT thus skipping ABS, AND, . . . etc. until it got to OCT$. Obviously, this

(continued on p. 211)

```
185 DATA1,7,7,21,33,43,50,53,54,60,
       60,61,74,81,86,91,96,96,105,116,
       121,125,129,129,129,129,129
190 CLEAR5000:DEFINTA-F:BS=129:CX$=CHR$(12):DIMCH$(BS),CC(27)
195 FORJ=1TOBS:READCH$(J):NEXT:FORJ=1TO27:READCC(J):NEXT
1100 FL=0:N=ASC(S$):IFN<65ORN>91THEN1115 ELSE N=N-64
1105 FORNN=CC(N)TOCC(N+1)-1:
       IFLEFT$(S$,LEN(CH$(NN)))=CH$(NN)THEN
              FL=LEN(CH$(NN)):T=FL:NN=CC(N+1)-1
1110 NEXT
1115 IFFL<>0THENS$=RIGHT$(S$,LEN(S$)-T):S2$=""
1120 S=LEN(S$):RETURN
1300 'SPOOL
1310 WIDTH80
1320 INPUT"DO YOU WANT (C)RT OR (L)INE PRINTER OUTPUT";F3$
1330 IFF3$<>"C"ANDF3$<>"L"THEN1320
1340 OPEN"I",1,F2$,0
1350 IFEOF(1)THEN1390
1360 LINEINPUT#1,A$
1370 IFF3$="C"THENPRINTA$ ELSE LPRINTA$
1380 GOTO1350
1390 CLOSE
1400 END
```

Listing 1.

ANNOUNCING A REVOLUTION IN THE COST OF PROFESSIONAL SOFTWARE



VISACCOUNT is a fully integrated business and accounting system designed for use in small businesses. VisAccount is extremely comprehensive and professional, yet it is very easy to use. The system is controlled from a series of interconnected menus permitting user-friendly operation. Everything you need to set-up and operate the system is provided with the VisAccount package.

ALL SYSTEMS is able to provide you VisAccount at this incredible low price because it runs on so many different machines. Through volume sales we are able to substantially reduce our prices.

OUR GUARANTEE — Buy both our software and that of our competitors (who will no doubt charge several times our price because they need to recapture their development cost). Compare the two systems and we know you'll return theirs (make sure they'll let you return their software). If you decide not to keep our system, then return it within 45 days for a full refund. Once you've used our system we're confident you'll be delighted.

† Microcomputers for Business Applications, 1979

VISACCOUNT™

What You Receive

- Nine 5¼'' double density disks (or six 8'' single density disks)
- Easy-to-use operator's manual (over 200 pages)
- Self-study guide on bookkeeping and accounting (over 180 pages)
- Cassette based instruction program on set-up and operation

Available for TRS-80 I, II & III, Apple* and most others.
*The Apple version requires the Microsoft Z80 softcard.
CSCA has CBASIC2, CP/M and Microsoft Z80 softcard in stock.

Send $199 for the VISACCOUNT system

FREE: MAILING LIST PROGRAM
Requirements: 48K
2 DISK DRIVES CP/M

ALL SYSTEMS Computer Services Corporation of America
332 East 30th Street New York, New York 10016
Order Toll Free **1-800-221-2486**
For New York and Technical Number 1-212-685-0090 ✓182

ALSO

WORD STAR	$249
SUPERCALC	$199
DATA BASE SYSTEM	$199
CP/M for TRS80 MODEL II	$ 99
TERMINAL PROGRAM for MODEL II CP/M	$ 39

Name ______________________

Address ______________________

City/State/Zip ______________________

☐ Master Charge ☐ Visa ☐ American Express

No. ______________ Expires ______________

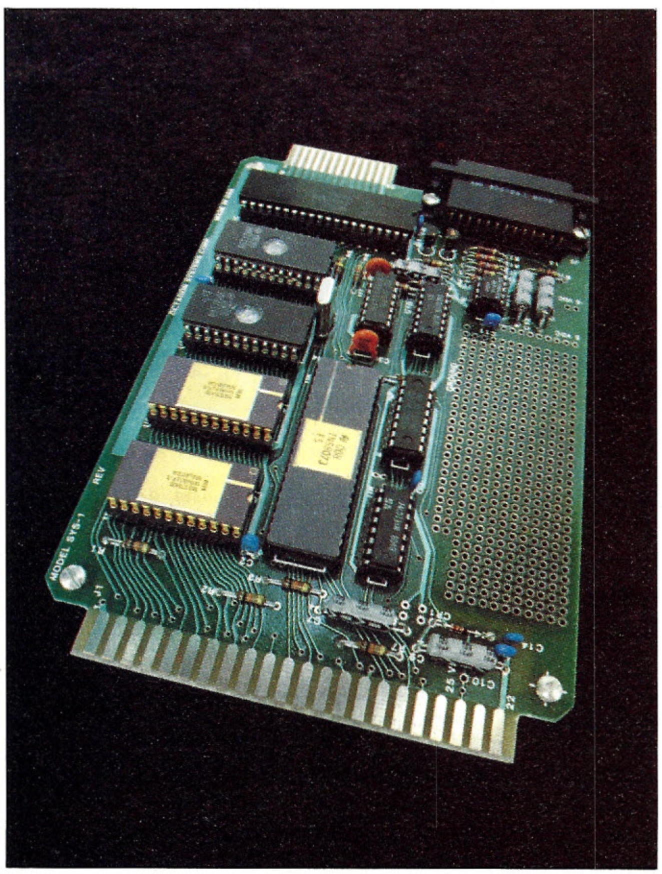
Your System ______________________

Disk Size ☐ 5¼'' double density ☐ 8'' single density

For home, business or industrial applications, this single-board do-it-yourself system has broad appeal due to its simplicity and low cost.

Everyman's Computer System

By John McKown and Steve Sarns



The 8073 single-board computer system.

If you haven't yet taken the plunge into microprocessors, here is a system that can make a beginner successful. You can assemble the computer and be programming it on the same day. If you're considering an intelligent home-security or energy-management system, you can build a low-cost system that won't tie up your not-so-low-cost personal computer. Changes to software can be made in one-tenth the time of most single-board computers, because this one talks an English-like BASIC language.

The system is designed to overcome the problems we've met in dealing with a variety of controller products. The number of computer applications in our company has skyrocketed over the last few years. Our non-product uses include controlling production equipment, running lab experiments, automatic printed circuit (PC) board testing, data logging and assisting test techs with tedious calibrations.

Usually, we've contracted with outside consultants to design and install systems. We now have a hodgepodge of custom designs with half a dozen different microprocessors. The documentation has been cryptic or worse, forcing us to rely on the designers for servicing. Since few of our people can program even one microprocessor in machine language, the biggest headache has been making software changes. Even so, it couldn't be done on the production floor where real-time tweaking is a must.

John McKown and Steve Sarns are engineers at Cobe Laboratories, Inc. 1201 Oak St., Lakewood, CO 80215.

Once again, we had to rely on the outside organizations to make even minor changes.

What we needed was a universal microprocessor system that was sufficiently simple so both our engineers and technicians could handle the hardware and software. Yet, it had to be powerful enough for most of our applications. Since we owned a lot of examples of what we didn't want, it wasn't difficult to develop the following criteria:

- Circuitry had to be readily understood by a wide range of personnel.
- It had to be programmable by nonprogrammers.
- It had to be field-programmable with nonvolatile memory.
- It needed a simple, inexpensive power supply.
- It had to be plug-replaceable, easy to package and serviceable.
- It needed sufficient I/O for most applications.
- It had to be easily expandable.

Since the system would be operated by personnel with little or no microprocessor experience, a high-level language was mandatory. We decided that a small BASIC interpreter would be ideal. To possibly simplify the circuitry, we also looked at several central-processor unit (CPU) chips with integral BASIC interpreters. Unfortunately, many Tiny BASICs have inconsistent syntax and lack meaningful error messages. However, we found an enhanced version that looked very good.

The design of a system was not yet a company project, so we got together nights and weekends to work out the hardware configuration. After trying several schemes, we settled on what appeared to be the least complicated version. The circuit can be wire-wrapped on a 4.5 by 4.5 inch PC card, but we used a standard 4.5 by 6.5 inch card so that some breadboard space would be left. Two cards were made and run through their paces independently. We then wrote a set of utilities that would make the card a "tiny" development system.

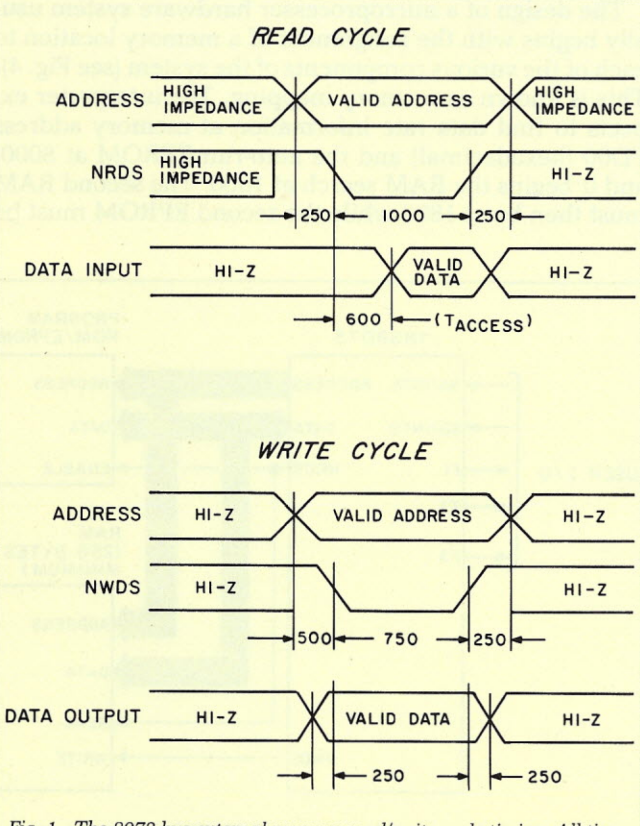


Fig. 1. The 8073 bus external memory read/write cycle timing. All times are given in nanoseconds and the system clock runs at 4 MHz.

Of the several CPUs with resident BASIC interpreters, the National Semiconductor INS8073 is by far the easiest to use. It's hard to imagine a bus and control structure more straightforward than National's MICROBUS. There are no multiplexed address and data lines and no tricky timing requirements, and it readily interfaces with all the common peripheral chips. NSC Tiny BASIC was developed specifically for control applications and has been used for several years with SC/MP and 8080 processors.

(This interpreter was originally called NIBL. All references to BASIC in the remainder of this article will be NSC Tiny BASIC.)

The Microprocessor

This microprocessor supports a classic eight-bit bidirectional data bus and a 16-bit wide address bus. Three active low I/O strobes are provided. The Read (NRDS) strobe transfers data from the data bus into an internal register. The Write (NWDS) strobe occurs when the data put on the bus is valid. Pulling the Hold (NHOLD) low locks the information on the data and address buses until released. This feature allows interfacing with slow peripheral devices. The timing diagram is shown in Fig. 1.

The microprocessor alone supports minimal I/O in the form of two sense inputs and three flag outputs. The sense inputs can generate interrupts (if enabled) and the flag outputs are latched. (In our system one flag and sense line are dedicated to the RS-232 port.) An internal oscillator will accommodate either a crystal or resistance-capacitance network. It is possible to construct a working system with only three devices—the microprocessor, a programmable random-access memory (RAM) chip and an erasable-programmable read-only memory (EPROM) chip containing the user program. The block diagram (Fig. 2) shows the interconnections for this system.

Upon power-up or reset the interpreter performs the following tasks:

- The size of RAM is determined.
- RAM is nondestructively tested.
- Variables and stacks are initialized.
- The data rate is established.
- A check for a program in ROM at 8000 (hexadecimal) is made. If one is present, program execution begins. Otherwise, the command mode is entered and the interpreter waits for user input.

Programs are entered directly into RAM via the RS-232 port. All characters are stored in memory as ASCII values, and thus no tedious code conversion is necessary while examining memory during debugging.

The Language

A high-level language will be recognized as a boon to anyone who has fought through the hand assembly of object code or purchased a costly development system. One of the prices paid in using a high-level language is that of speed. Fortunately, most control applications do not require the fast execution speed of machine language. However, should the need arise, the LINK command will jump from BASIC to an object-code subroutine and re-

turn. (The interpreter comes in handy when debugging machine-language programs.)

Another possible limitation of this BASIC is that of integer math. The two-byte format limits the integer-value range to ±32,767. In most instances this does not represent a serious constraint. By carefully scaling the data, the loss of resolution can be minimized; indeed, through more advanced programming, the problem may vanish.

The common BASIC statements supported include:

●NEW—sets the end of program pointer equal to the beginning address effectively erasing any program resident in RAM and signalling new program entry.
●RUN—runs the current program.
●CONT—continues execution at the point of suspension.
●LIST <expression>—lists the current program starting at line number (expression); default value is the first line number.
●REM (Remark)—skipped over during execution.
●CLEAR—initializes all variables and stacks; done automatically when a program is run.
●LET—optional.
●PRINT <expression>—prints value of <expression>. (Multiple outputs are separated by a comma. An ending semicolon suppresses the carriage return.)
●IF/THEN—THEN is optional.
●FOR/NEXT. . . STEP—STEP is optional.
●DO/UNTIL.
●GOTO <expression>—expression can be a number or variable.
●GOSUB <expression> / RETURN—expression same as GOTO.
●INPUT—inputs can be a number or a string.
●DELAY <expression>—delays up to 1040 ms in steps of 1 ms.
●LINK <expression>—executes machine-language routine beginning at memory location (expression).
●TOP—returns the next available RAM address.
●MOD <a,b>—returns the remainder of a/b.
●RND <a,b>—returns a random number between a and b inclusively.

In addition to these standard statements NSC Tiny BASIC has the following enhancements.

●ON <expression>—causes vectored interrupts from the sense inputs—the statement ON 2,200 causes a jump to line 200 when sense B (pin 39) goes low.
●NEW <address>—initializes pointer to a BASIC program without destroying any other program; thus, several different programs may reside in memory (RAM and/or EPROM) at once.
●STAT—allows examination and modification of the status register.
●@<expression>—a shorthand version of PEEK and POKE.
@2000 = 67—puts 67 at address 2000.
A = @1200—gives variable A the value at address 1200.
Let @3000 = @4000—copies contents of address 3000 into address 4000.
●INC <X>, DEC <X>—these are used in multiprocessing applications (see National's literature).

Four arithmetic, six relational and three logical operators are recognized:

● +, −, *, /	add, subtract, multiply and divide
● <, =<, >=, >	less than, less than or equal to, greater than or equal to, and greater than
● < >, =	not equal to, equal to
● AND, OR, NOT	logical and, or, not

The capacity for string handling enhances the versatility of the interpreter. Strings are stored in ASCII starting at the address contained in the variable named. The statement A = 9000 tells the interpreter to store $A in memory beginning at location 9000. Thus:

```
>A=9000 : $A="NSC TINY BASIC" : PRINT A,$A
```

will produce 9000 NSC TINY BASIC. A string move statement is supported, allowing very fast reading from or writing to peripheral devices.

The error codes of the 8073 are a substantial improvement over the "HOW" and "WHAT" of the early interpreters. (See Fig. 3.)

The Hardware

The circuit was reduced to simplest form without compromising function. We set the size and capabilities of the system to match most of the applications we had seen. More than 150 lines of BASIC text can be stored in 4K bytes of EPROM. The 4K of available RAM might be used for program development while only 2K might be used for an operating system. Even the slowest EPROM and RAM chips have more than adequate timing margins. (The Toshiba 2016, Hitachi 6116, T.I. 4016, Mostek 4802 and others all work well.)

The system has the following features:

●Up to 4K bytes of RAM in 2K increments.
●Up to 4K of EPROM in 2K increments.
●Up to 8K of external RAM and/or EPROM.
●Addresses up to 2000 peripheral devices.
●A resident EPROM programmer.
● +5 V operation (EPROM programmer requires +25 V).
●27 programmable I/O ports.
●A peripheral device select line.
●Serial I/O port—110, 300, 1200 and 4800 bits per second (bps).

The design of a microprocessor hardware system usually begins with the assignment of a memory location to each of the various components of the system (see Fig. 4). This is known as memory mapping. The interpreter expects to find data rate information at memory address FD00 (hexadecimal) and the auto-run EPROM at 8000, and it begins the RAM search at 1000. The second RAM must then be at 1800 while the second EPROM must be

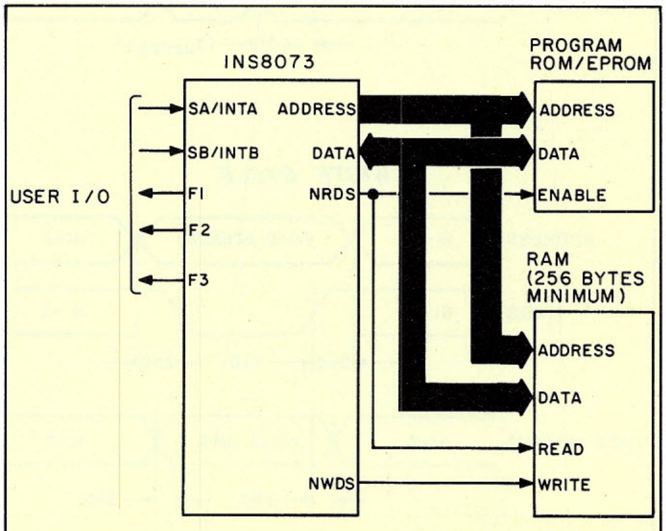


Fig. 2. Block diagram of the minimum ROM/EPROM-based system.

at 8800 for continuous memory. The internal BASIC interpreter is located at 0000, and the internal RAM is mapped at FFC0.

These addresses set the decoding scheme. The remaining decoder outputs map the programmable interface at 0A00 and the peripheral function select at 9800 (2000 addresses). The 4000–7FFF block of code is an "image" of the C000–FFBF data rate address and cannot be used. This leaves 2000–3FFF free for external decoding, if desired (8000 addresses).

Circuit Description

The 8073 requires few external components. The self-contained crystal oscillator is buffered to drive four low-power Schottky transistor-transistor logic (LSTTL) loads. While the oscillator will operate over a range of 100 kHz to 4 MHz, the 4 MHz used in this system is necessary for accurate data rates. The data and address lines will drive four LSTTL loads.

The RS-232 input circuit operates over a ± 3 V to $+12$ V range. Q1 acts as a threshold detector and inverter. The output stage (Q2) swings from about -4.5 V to $+5$ V, which exceeds the minimum RS-232 specs. The -5 V for the output stage is supplied by the voltage converter, U11. R3 and C7 form a power-up reset for the processor. This line is buffered and inverted for the 8255 and external devices.

Since the pin-outs of the 2K by eight-bit RAMs and EPROMs are the same, the devices are interchangeable in the RUN mode. If your operating system requires only one RAM chip and you want to save a little money, a 1K by eight-bit RAM like the 4118 could be used for U1. *(Caution:* You can't use a 1K RAM while developing programs because the interpreter expects 2K.)

The data rate is set by tying U9 to P12 and U9 to P14 high or low. The processor wait or hold line (NHOLD) is activated either by the EPROM programmer or an external input (active low) through U10. (See Fig. 5.)

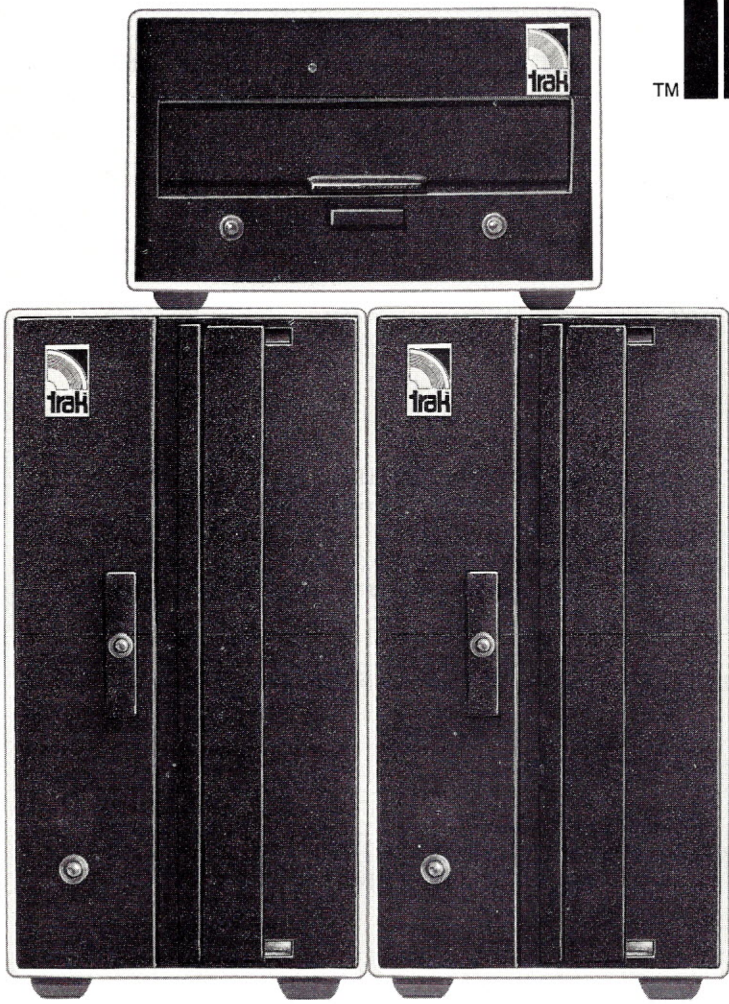
The 8225, U5, programmable peripheral interface chip has 24 I/O lines that can be individually software configured as either an input or output so that no external hardware is needed. The chip has three operating modes, but the description is too detailed to discuss in this article. We will briefly cover mode 0, the most common, and suggest that those who are interested in the remaining modes consult the data sheet.

The device is divided into three ports: (A) PA0 to PA7,

Error code	Explanation
1	Out of memory
2	Statement used improperly
3	Unexpected character (after legal statement)
4	Syntax error
5	Value (format) error
6	Ending quote missing from string
7	GO target line does not exist
8	RETURN without previous GOSUB
9	Expression, FOR-NEXT, DO-UNTIL or GOSUB nested too deeply
10	NEXT without previous matching FOR
11	UNTIL without previous DO
12	Division by zero

Fig. 3. The 8073 error codes.

Get on the right trak™ in floppies with new trak™ 5¼″ & 8″ disk drives



TRAK — the way to go — in floppy disk drives.
Whether you are just setting up your computer system, expanding it, or re-equipping — make it TRAK.

With TRAK you get the finest of industry-standard disk drives, custom electronics and custom cabinetry. In your choice of office beige or silver gray. And other options like door locks, front bezels, write-protect switch, extender card and more.

Drives with the industry's fastest access time — from 3 to 5 ms. With up to 9200 hours MTBF. 40, 77, 80 track. Single or double density. Single or double sided. Up to 1.6 MegaByte capacity. Single, dual or triple cabinets. With or without power supplies. And a TRAK exclusive — dual LED panel indicators for Power-On and In-Use. Convenient — as you know if you've ever left things "on" for long periods without realizing it. Compatible with TRS-80®, Heath/Zenith, Northstar, Apple II® and most S-100 based systems.

Custom electronics — custom transformers — for 110VAC or 220VAC, 50 or 60 Hz. Fused for protection. With regulation for low ripple and constant output even with input variation. Quiet convection cooling through vents on all cabinet sides without the need of noisy, bothersome fans.

Low prices. Complete 5¼″ drives list as low as $399, complete 8″ drives as low as $899 list. And your TRAK dealer gives you the best of everything — in price and service, in or out of warranty. Standard TRAK warranty is 90 days; 12 month extension available at extra cost. Check your dealer now for the right TRAK in disk drives — TRAK.

5¼″ from $399 list
8″ from $899 list

For the name of your nearest dealer and full details, Call Toll-Free 1-800-323-4853

or write:

International inquiries invited.
Dealerships available.

trak™ ✓388
microcomputer corp.
1511 Ogden Ave., Downers Grove, IL 60515

® TRS-80 is a registered trademark of Radio Shack, a Tandy Company
® Apple II is a registered trademark of the Apple Computer Company

$25 INTRODUCTORY FACTORY REBATE $25

Buy from your TRAK dealer, then mail copy of sales receipt with TRAK serial number and this coupon to TRAK. We will rebate $25 direct to you as our way of welcoming you to the TRAK drive family.

Name________________

Address________________

City__________ State________ Zip______

Offer expires Nov. 30, 1981. Limit one rebate per customer. Offer void where prohibited.

✓See List of Advertisers on page 210

(B) PB0 to PB7 and (C) PC0 to PC7. The chip select line (U5 to P6) is mapped at 0A00 (hexadecimal) so that port A is addressed at 0A00, port B at 0A01 and port C at 0A02. An internal control register is mapped at 0A03. The control word determines the I/O configuration. For example, the control word 10 (hexadecimal) makes all lines inputs and the control word 9B makes them all outputs.

```
>@#0A03=#10    REM MAKE THEM ALL INPUTS
>@#0A03=#9B    REM MAKE THEM ALL OUTPUTS
```

See the 8255 data sheet for the other combinations. Drive requirements in excess of about one TTL load will require external buffers. On power-up the 8255 initializes into the all-input mode.

The EPROM programmer is read at 8000 (hexadecimal) and written to at 9000. When you power-up or type NEW #8000, the interpreter determines whether that location is RAM or ROM by saving the information at 8000 and trying to write a test number into 8000. If it is successful, it restores the previous byte and treats that location as RAM. If not, it concludes that ROM is at 8000. If you have your utility chip in that socket and your +25 V programming supply is on, it will write over the first byte rendering your utility chip useless. Thus, placing the programmer at 9000 minimizes this type of error.

When writing to 9000 through 97FF with the +25 V programming supply connected, data will be programmed into U4. The decoded address (U8 to P9) and the write (NWDS) are applied to pins 2 and 3 of U2. The output goes high triggering the 50 ms one-shot, U7. The output (U7 to P6) drives the NHOLD line (U6 to P5) low via U10. This locks both the address and data buses in their present state until the one-shot output goes low.

```
0PR"SYS-1A *OCTAGON SYSTEMS CORP* (C) 8/81"
1S=@#FFD9*256+#E8:T=S+20:U=@#FFD5*256:$S="-------":PR"":PR"Select"
2PR$S:PR"<1> MOVE BASIC PROGRAM"
3PR"<2> COPY MEMORY"
4PR"<3> HEX DUMP"
5PR"<4> DEC/HEX CONVERT"
6PR"<5> LLIST SERIAL"
7INPUTI:PR"":GOTOI*10*(I>0)*(I<6)
8Y=@(J+I):IF(Y=127)OR(Y>57)OR(Y<49)X=0
9RETURN
10PR$(U+#77):PR"SOURCE":GOSUB80:GOSUB81:INPUTJ:IFJ=0GOTO1
11J=J-#10FF*(J=1)-#7FFE*(J=2):V=#1100:W=#8000:X=#9000:Z=#9800
12IF(J<V)OR((J>S)AND(J<W))OR(J>=X)PR"*NO SOURCE":GOTO10
13PR"DESTINATION":GOSUB81:INPUTK:K=K-#10FF*(K=1)-#8FFE*(K=2)
14IF((K<V)AND(K>=0))OR((K>S)AND(K<X))OR((K>=Z)AND(K<0))PR"*NO DEST":GOTO13
15L=0:IF(J=V)AND(@(TOP-1)=127)L=TOP-V-1
16I=0:IFK<0GOSUB82:GOTO19
17$(K+I)=$(J+I):PR$(K+I):DO:I=I+1:UNTIL@(J+I)=13:I=I+1:GOSUB8:IFX<>0GOTO17
19@(K+I)=127:GOSUB90:GOTO1
20PR$(U+#93):GOSUB80:PR"destination";:INPUTK:IFK=0GOTO1
21PR"source start";:INPUTJ:PR"source end";:INPUTL
25DO:@K=@J:K=K+1:J=J+1:UNTILJ>L:GOTO1
30PR$(U+#A8):GOSUB80:PR"start at";:INPUTJ:IFJ=0GOTO1
33FORI=JTOJ+255STEP16:N=@#1011:GOSUB70:N=@#1010:GOSUB70:PR" ";
35$S="................":FORK=0TO15:L=I+K:N=@L:GOSUB70:PR" ";
36IF(N>31)AND(N<127)@(S+K)=N
37NEXTK:PR"    ",$S:NEXTI:GOTO30
40PR$(U+#BA):GOSUB80
41PR"":PR"dec=";:INPUTD:N=@#1007:GOSUB70:N=@#1006:GOSUB70:IFD=0GOTO1
42GOTO41
50PR$(U+#D2),"source";:INPUTJ:PR"printer on";:INPUT$T
51PR$J:DO:J=J+1:UNTIL@J=13:J=J+1:DELAY200:IF@J<>127GOTO51
52 PR"print OFF":INPUT$T:GOTO1
70$T="00":@(T+1)=MOD(N,16)+48:@T=N/16+48:@T=@T-(@T>57)*7
71@(T+1)=@(T+1)-(@(T+1)>57)*7:PR$T;:RETURN
80PR"<0>         EXIT TO MENU":RETURN
81PR"<1>         RAM (#1100)":PR"<2>         EPROM":PR"<address> OTHER":RETURN
82PR"length=";:IFL=0L=J:DO:L=L+1:UNTIL@L=127:L=L-J
83PRL+1,"bytes":IFL>2047PR"*NO FIT <cont>":STOP
84PR"Turn on +25";:INPUT$T
85$(K+I)=$(J+I):PR$(K+I-4096):IF@(K+I-4096)<>@(J+I)PR"*BAD BIT":STOP
86DO:I=I+1:UNTIL@(J+I)=13:I=I+1:GOSUB8:IFX<>0GOTO85
87PR"turn OFF 25V":INPUT$T:RETURN
90PR"":PR$(U+#65):PR$S:GOSUB80:PR"<1> go to dest":INPUTH:IFH<>1RETURN
91@#FFD4=@#1014:@#FFD5=@#1015
92I=I+K:IFK>0@#FFD6=@#1010:@#FFD7=@#1011
```

Listing 1. Utility programs for our 8073 system are Dump, Move, Copy Memory, Dec/Hex and LList.

The microprocessor actually halts during this interval.

Programming the System

Generally speaking, this system programs like bigger computers. National Semiconductor has two publications that contain detailed information on the language. *Using NSC Tiny BASIC* is a 20-page summary of the language which will be adequate for anyone who has had previous programming experience. The *NSC Tiny BASIC User's Manual* is much more detailed, with some programmed instruction. The presentation is somewhat uneven, and there are a few minor errors, but it would be excellent for those who have never programmed in any high-level language. It is not possible to cover the language in detail in this article, but we can offer some hints and information that will help in programming:

- Program lines may contain multiple statements separated by a colon.
- Maximum line length is 72 characters.
- A string is any sequence of numbers or ASCII characters terminated with a carriage return. There is no limit to the length of a string.
- Each statement is stored literally, not as a single-byte token. For example, PRINT requires five memory locations.
- Including the optional LET will speed program execution.
- Multiple statements on a line generally speed execution.
- Use parentheses in complicated arithmetic expressions.
- Memory can be saved (although it's cheap these days) by leaving out optional words, remarks and extra spaces, and by using more than one statement per line.
- The break key will stop normal program execution. Control-C must be used to break an INPUT statement.
- More than one program may reside in RAM at one time but only the current program may be modified. How-

Location (Hexadecimal)	Function
0000–09FF	BASIC interpreter ROM
0A00–0FFF	Programmable Interface
1000–17FF	First 2K of RAM
1800–1FFF	Second 2K of RAM
2000–3FFF	Unused
4000–7FFF	Data Rate Select
8000–87FF	First 2K of EPROM
8800–8FFF	Second 2K of EPROM
9000–9800	EPROM programmer
9800–9FFF	Peripheral Device Select
A000–BFFF	Unused
C000–FFBF	Data Rate Select
FFC0–FFFF	Internal 64 bytes of RAM

Fig. 4. Memory map indicating the memory locations of the various components of the system.

Data Rate	D1	D2
110	H	H
300	L	H
1200	H	L
4800	L	L

Fig. 5. These data rates achieved by four combinations of high/low inputs.

ever, the others may be listed and run.

- Pushing the reset button does not destroy the contents of RAM or your program but it does destroy the program pointers. You can still run or list the program but you can't modify it without changing the pointers.
- The interpreter accepts only uppercase characters but it can print both upper and lowercase.
- The first statement of an auto-run EPROM must be CLEAR.

To begin writing a program, you must give the computer a beginning address. The interpreter allocates the first 256 bytes of RAM. Since RAM starts at 1000 (hexadecimal) the first available location for the user is 1100. Any higher RAM address may also be used. This BASIC uses the # symbol to designate a hexadecimal number. Thus you enter:

>NEW#1100

You now tell the computer that you want to start a new program:

>NEW

The interpreter writes an end-of-program marker (127) into 1100, effectively erasing the previous program as far as the interpreter is concerned. The interpreter is now ready to begin entering your program into RAM.

System Utility Library

Utility programs can provide the user with handy software to aid in developing, debugging and storing programs. Most utilities for small systems (and many large systems) include an abbreviated notation that must be referred to if the utility is not often used. A menu-driven utility with prompting in everyday English significantly reduces the hassle. Our routines have as many error-catching features as memory would allow (2048 bytes are used). A very brief overview of the utilities (given in Listing 1) follows:

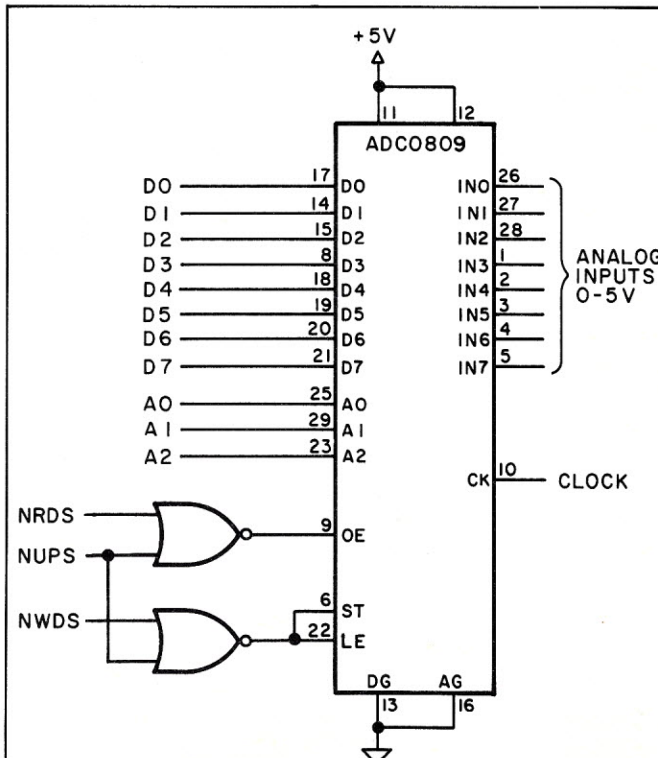


Fig. 6. Eight-channel, eight-bit A/D converter.

Now for the TRS-80™ Models I & III

LDOS

VERSION 5.1
THE TRS-80™ OPERATING SYSTEM
MODEL I AND III

- * **DOUBLE** Sided & **DOUBLE** Density support.
- * **AUTOMATIC** Density recognition.
- * 35, 40, 77, 80 and any other track counts are supported.
- * All available drive stepping rates are supported.
- * Hard Drive support, can be **HANDLED AS A SINGLE DRIVE.**
- * Hard drive partitioning, one drive can act as up to six.
- * Intermix 5", 8" and Hard drives, up to a total of 8 drives.
- • Compatible with the Model I Radio Shack Expansion Interface.
- • Upward compatible with **TRSDOS** (2.3 & 1.2 as documented).
- • Fully supports Microsoft language products for the **TRS-80.**
- • Complete media compatibility Model I to Model III and back.
- • Full support for **LOBO's LX-80** interface.
- • Full support for **AEROCOMP LC** double density controller **(DDC).**
- • Full support for **PERCOM's DOUBLER II.**
- • Complete documentation (well over 250 pages).
- • Complete technical information.
- • A **TOLL-FREE** 800 number for customer service.
- • An **LDOS** users bulletin board on MicroNET.
- • A Quarterly **LDOS** users magazine (The **LDOS QUARTERLY**).
- • A liberal update policy.
- • An enhanced **BASIC (LBASIC)** including:
  - > Upward compatible with Microsoft Basic.
  - > High speed **LOAD** and **SAVE**.
  - > Run multiple programs with common variables.
  - > **BLOCKED** (variable length) files are supported.
  - > **DOS** commands may be executed from **LBASIC.**
  - > Built in string array. **SORT.**
  - > Single stepper for debugging.
  - > Several new statements and file modes.
- • A compiled **JOB CONTROL LANGUAGE (JCL).**
- • **CONV**ert utility to move files from Model III **TRSDOS.**
- • An Extended Debugging and Monitor program (with disk access).
- • **CMDFILE** for movement of disk and/or tape system **(/CMD)** files.
- • Device independent operation.
- • Full **LINK**ing, **ROUTE**ing, **FILTER**ing and **SET**ting are supported.
- • Mini**DOS** feature for constant access to certain **DOS** commands.
- • **RS-232 DRIVER** for serial support.
- • Sophisticated communications software included.
- • Wildcard characters and partial Filespecs are supported.
- • **DATED FILES,** show when a file was last written to.
- • Backup: Mirror, by Class, if Modified, by Date, by Extension, etc.
- • Selectable **PURGE** for fast disk "cleanup" of unwanted files.
- • Print formatter, for control of printer output.
- • Built in printer **SPOOLER,** to both disk and ram.
- • Joblog to record all system operations with time stamps.
- • **UPPER** and *lower* case support, throughout the system.
- • Blinking cursor with selectable cursor character.
- • 128 character **TYPE AHEAD** buffering for keyboard input.
- • Assign strings to individual keys with Key Stroke Multiply **(KSM).**
- • **SUPER FAST** operation with the **SYSRES** feature.
- • Extensive user control and system feedback.
- • Advanced **PATCH** utility for easy maintenance.
- • Complete transportability of software among all **Z-80 LDOS** systems through the use of the **LDOS** high ram supervisory call system **(SVC).**
- • Dealers to serve users Nationwide and in the Common Market.
- • The only **DOS** with a limited **ONE YEAR WARRANTY!**
- • Enjoy a professional operating system on **YOUR TRS-80!**

* Specific hardware is required to use these features.

The Ultimate In Operating Systems For Model I & III

Only $169⁰⁰

Version 5.1

* Model I LDOS provided on 35 track single density media.
* Model III LDOS provided on 40 track double density media.
* LDOS can be provided on special media configurations at an additional charge.
* Prices & Specifications are subject to change without notice.

† Although not required, LSI recommends two or more drives when using LDOS.

For Further Information Contact The Distributor Or Dealer Nearest You:

(West)	(Central)	(East)	(The Common Market)
LOBO DRIVES INT'L	**GALACTIC SOFTWARE LTD.**	**MISOSYS**	**MOLIMERX LTD.**
354 S. Fairview Ave.	11520 N. Port Washington Rd.	5904 Edgehill Dr.	1 Buckhurst Rd., Bexhill
Goleta, CA 93117	Mequon, WI 53092	Alexandria, VA 22303	Sussex, England
(805) 683-1576	(414) 241-8030	(703) 960-2998	(0424)-220391

DEALER INQUIRIES WELCOME. LDOS is a product of LSI. TRS-80 & Radio Shack are trademarks.

LOGICAL SYSTEMS INC.

322

Mequon, WI 53092
(414) 241-3066

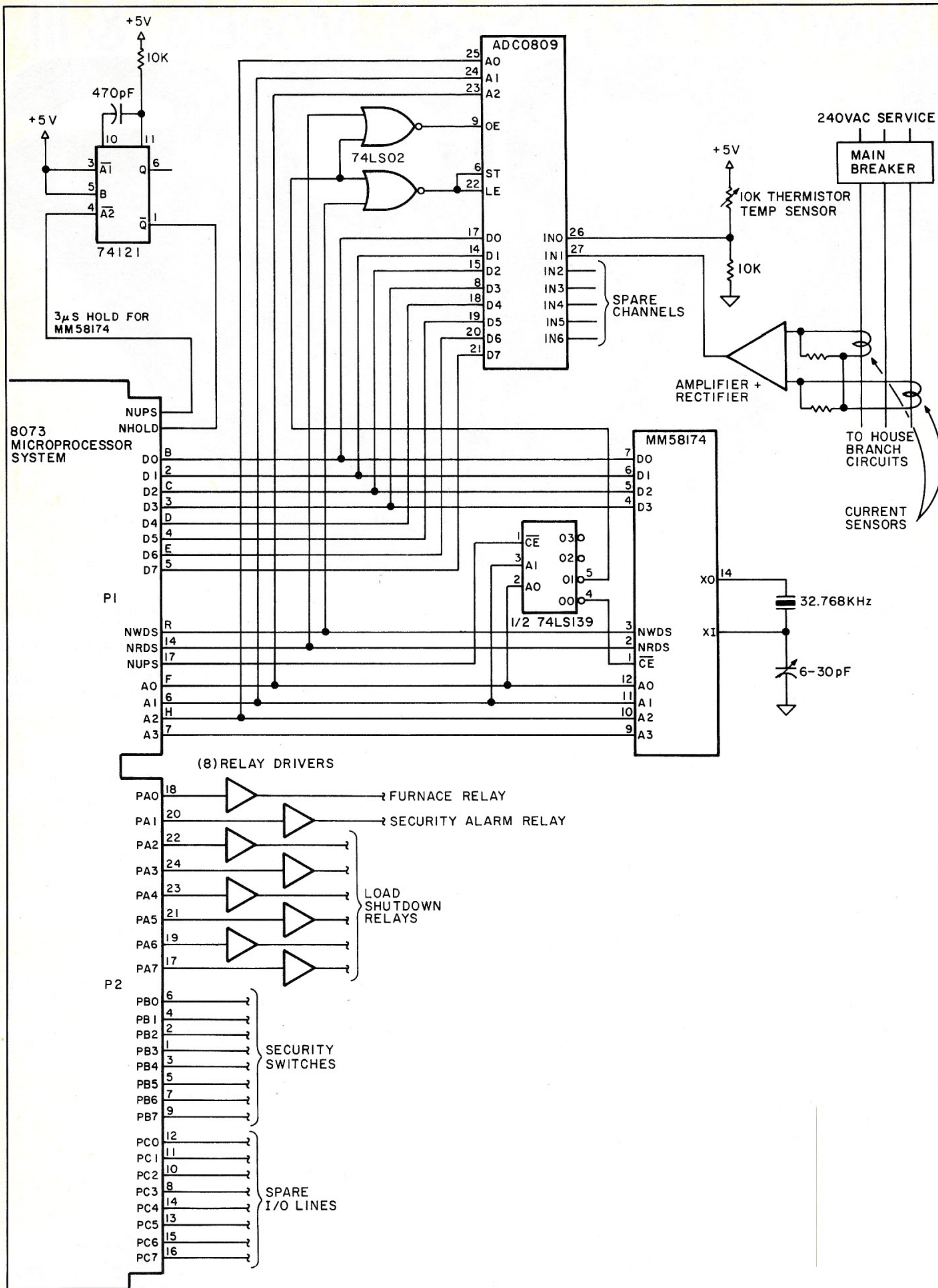


Fig. 7. A circuit, using an MM58174 real-time clock, that gives you an 8073 home energy and security management system.

●DUMP—Prints lines of memory in hexadecimal and ASCII.
●MOVE PROGRAM—Block-moves a BASIC program from EPROM or RAM to another RAM location.
●COPY MEMORY—Copies any block of code from one part of memory to another.

Either the MOVE or COPY command may be used to program an EPROM. The destination address is 9000, the EPROM programmer.
●DEC/HEX—Converts any decimal number 0–32767 to its hexadecimal equivalent. (A hex/dec converter is built into the interpreter.)
●LLIST—Sends the program text to a serial printer.

You can enter this software into RAM, test it and, using its own EPROM routines, program a 2716 EPROM. Place the EPROM in the socket at U4, type <NEW #8800> and you are off. The prompting makes each routine self-explanatory.

System Applications

To program the system, you will need to communicate through the RS-232 port. This can be done with nearly any dumb terminal, a computer with a similar port, or one of the $150 terminal kits and your TV set. The interpreter accepts only uppercase characters and operates in the full duplex mode.

Before you can run, you must set the data rate. The data rate is programmed by strapping the inputs (P12,14) of U9 either low or high. A data rate of 4800 bps is the usual choice for terminals. A pull-up resistor keeps D7 high during the data rate read time. (Fig. 5 lists the four combinations.)

The next step is to set the pulse width of the EPROM programmer. Make sure that the socket at U4 is empty and place a scope probe on U7 to P6. Now enter the following program:

```
>NEW #1100
>NEW
>10 @ #9000=255 : GOTO 10
>RUN
```

Adjust the 20k potentiometer until the pulse width (positive) is just 50 ms. When properly adjusted, about 16 pulses per second will be seen. Setting it more than 55 ms may damage EPROMs and less than 45 ms may result in incomplete programming.

Hard copy of your programs can be printed by a low-cost serial printer or the 8255 can be programmed to handle a Centronics or similar parallel interface. We use Epson MX-70 printers in our systems with software written in machine language to get the maximum printing speed. The BASIC interpreter was an invaluable aid in writing that software. Once the program is written, debugged and committed to EPROM, the terminal does not need to be used. For example, a simple security system might have only switch inputs, and indicator and alarm outputs.

A common need for both industrial and home applications is analog-to-digital (A/D) conversion. An ideal chip for this system is the ADC0809 (National and Texas Instruments), which is an eight-channel, eight-bit converter with a 0 to +5 V input range. The clock signal can be divided down from pin 7 of the 8073 oscillator or it can be a simple two-gate oscillator. The interface for this chip is shown in Fig. 6.

This 50-cent interface illustrates the simplicity of the bus structure. The software is also uncomplicated. A/D conversion is started by writing to the channel number

✓See List of Advertisers on page 210

you want. Since the 100 μs conversion time of the ADC0809 is faster than the command interpretation, you can read out the data in the same program line. The one-line program below prints out A/D channel 0 as fast as the interpreter can execute the instructions (about 35 conversions and printouts per second). The 0 is arbitrary and could be any number. (The software examples have extra spaces for clarity and include helpful remarks. These could be omitted in an actual program.)

```
>10 @#9800=0 : PRINT @#9800 : GOTO10
```

A program to convert and print out all eight channels is still relatively simple:

```
>10 FOR X=0 TO 7                :REM SCAN ALL 8 CHANNELS
>20 @(#9800+X)=0                :REM CONVERT
>30 PRINT @(#9800+X);           :REM PRINT IT
>40 NEXTX : PRINT"" : GOTO10    :REM DO IT AGAIN
```

The trailing semicolon in line 30 suppresses the carriage return so that all eight channels are printed on one line. The statement PRINT "" performs a carriage return and line feed. Despite using about twice as much code as the first example, the speed is still more than 25 conversions per second (joystick heaven!).

Here in Colorado, we're facing another large energy cost increase this winter. More homeowners are considering energy-saving devices, such as automatic setback thermostats. Using a computer system for this task has several advantages over electromechanical devices. You can have as many different cycles as you need without increasing the cost. It can easily control other energy-saving devices. It has the power and flexibility to simultaneously perform other tasks, such as home security.

In our state, 45 percent of the cost of a setback thermostat is deductible from income taxes (30 percent state, 15 percent federal). Fig. 7 shows a possible application. The key to this circuit is a National MM58174 real-time clock which counts seconds, minutes, hours and dates. You can access any of these counters separately. Other real-time clock chips could also be used.

A thermistor connected to the A/D converter can be placed near your present thermostat. One output of the 8255 drives a small relay that controls the off/on cycles of the furnace.

Also shown is a peak demand controller that could be used both in home and industrial environments. In most localities, the power company will sell electricity at a reduced rate if your usage is below a certain peak value. Say that you have an electric home with the heat on in all rooms. When you turn on the electric dryer, the line current exceeds the peak limit. Your computer system could temporarily shut down the heat in the laundry room to compensate. The scheme measures the total ac current, detects when the peak has been exceeded and goes to a lookup table to determine what to shut down. Using a real-time clock, the table could vary according to the time of day. It's easy to see that tuning up the system is so much easier by changing the software rather than hardware.

Other inputs and outputs can handle the security system. Even in this simple application, the computer system is less expensive than the assortment of components needed to do the same task. It's convenient to be able to quickly step through the program to check the external hardware.

Industrial users often need to prompt operators. This has usually been done with back-lighted buttons or numeric displays. There are now a number of alphanumeric displays that readily interface with computers. The major advantage of alphanumerics is that all the messages may be completely spelled out and require only a few minutes on the keyboard to change. This feature

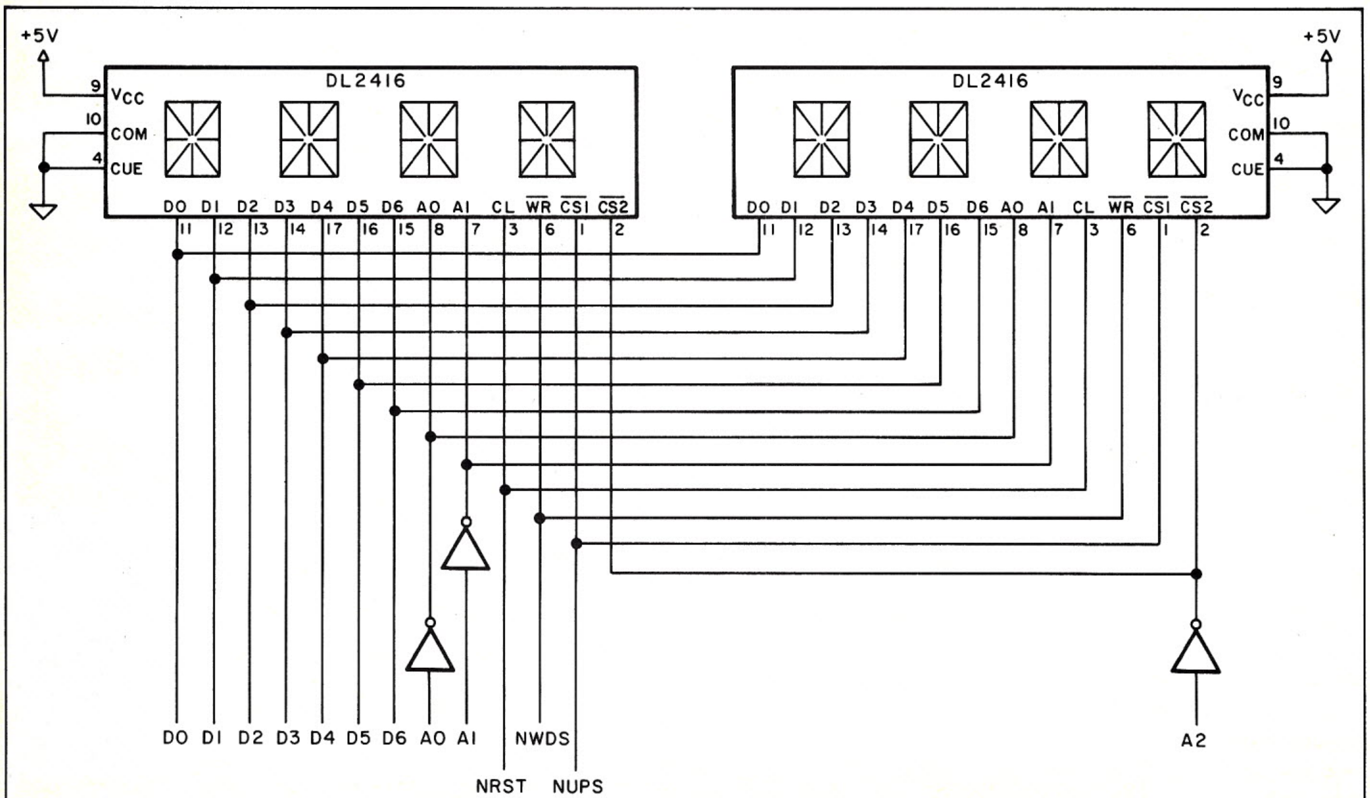
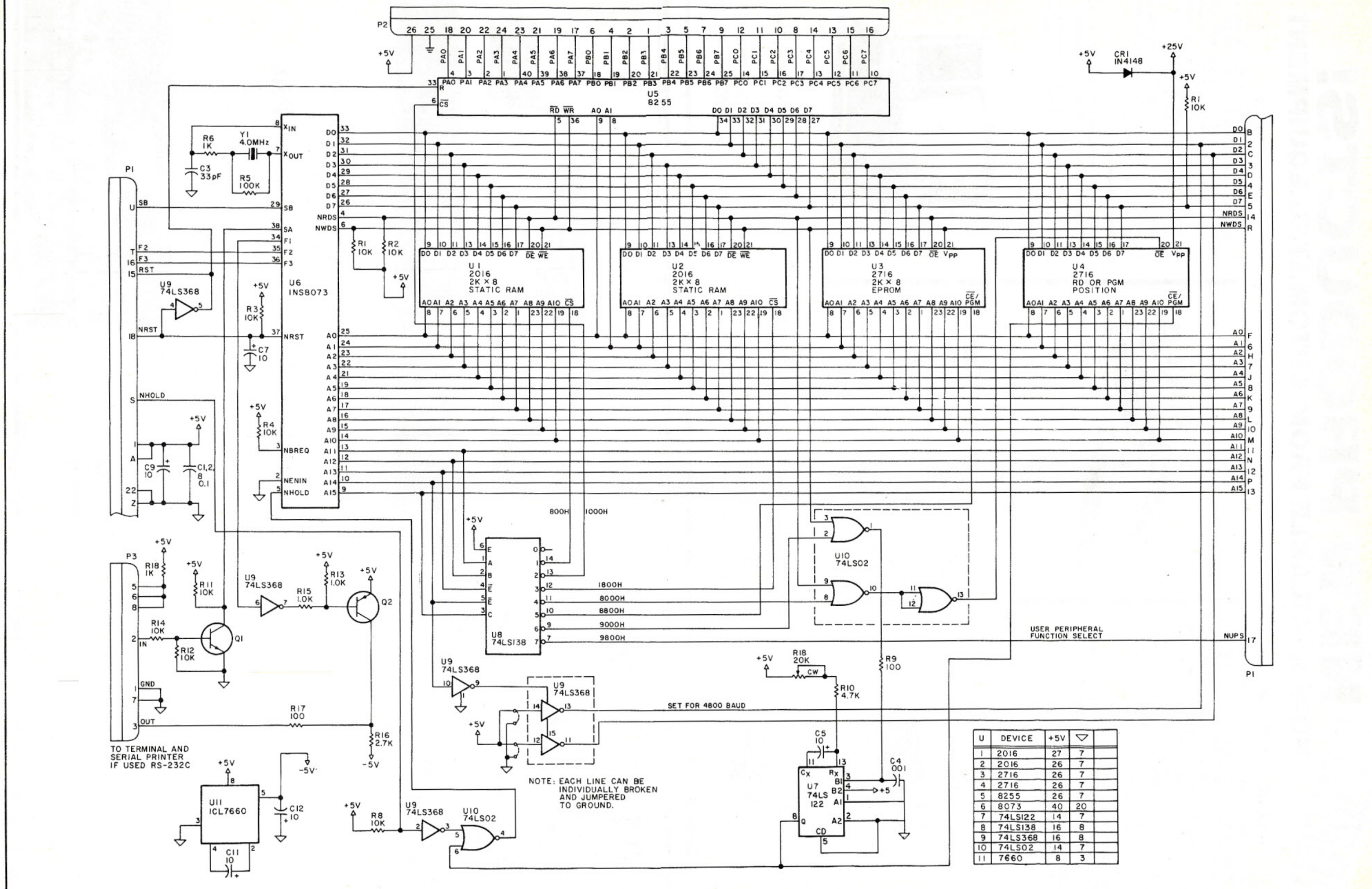


Fig. 8. Simple interface needed for an eight-digit alphanumeric display.



U	DEVICE	+5V	▽	
1	2016	27	7	
2	2016	26	7	
3	2716	26	7	
4	2716	26	7	
5	8255	26	7	
6	8073	40	20	
7	74LS122	14	7	
8	74LS138	16	8	
9	74LS368	16	8	
10	74LS02	14	7	
11	7660	8	3	

Fig. 9. Schematic of the 8073 system.

eliminates costly and time-consuming hardware modification. The interface for the Litronix DL-1416 or DL-2416 four-digit display is almost trivial. This is due in part to the fact that latching, decoding and character generation are built into the chip. Only three inverters are needed for eight digits of alphanumeric display. (See Fig. 8.)

Note that the address lines A0 and A1 are inverted to make the left-most digit 9800 (hexadecimal) and the right-most digit 9807. You can display information in several ways. For example, running the program below will illustrate the blazing speed of a string move and allow you to enter your own messages.

```
>10 B=#9800     :REM  DISPLAY ADDRESS
>20 INPUT $B    :REM  GET $B AND DISPLAY IT
>30 GOTO 20     :REM  DO IT AGAIN
```

ASCII characters can also be directly poked into any of the eight locations using the @<expression>=ASCII statement.

Conclusion

The system we have just described is a powerful and flexible microprocessor system. The choice of CPU and careful circuit design has yielded a system that can be understood by those with different levels of electronics background. Because it uses the BASIC language, even those who have no formal training in electronics can program the system. The basic system has sufficient I/O to meet the needs of most small controllers and can be expanded to control literally hundreds of external devices. The user can write programs, debug them and commit them to nonvolatile memory while sitting at his desk. Programming takes one-tenth the time of assembly-language programming at a cost of less than one-tenth of a development system. The system's low cost will make it useful for home as well as industrial applications.■

Other Applications

We have done a number of things not described in the article with our 8073 system. These involve the following:

- 500 bit per second enhanced cassette interface
- Parallel interface for the Epson MX-70/80 printers
- Synthesized speech
  1. NSC Digitalker
  2. Votrax Type & Talk
- Eight-channel 12-bit A/D converter
- Various D/A converters
- 128-channel, two-wire serial data acquisition and remote control
- Carrier control of remote line operated devices (BSR type)
- Various machine-control applications
- Nonvolatile RAM data save
- Numeric and alphanumeric displays
  1. Low cost, numeric, eight-digit LED with single chip driver
  2. 64 character, LED, alphanumeric
  3. 32 character, LCD dot matrix, alphanumeric
  4. 40 character, vacuum flourescent, dot matrix, alphanumeric
- Software
  1. BASIC text line editor
  2. Advanced utilities for both BASIC and object-code programming
  3. Assembler for object-code programs
  4. Disassembler for object-code programs
  5. Parallel printer interfaces with handshaking
  6. Numerous subroutines in BASIC and object code for control applications.

The computer in this article is available as a kit ($175). The kit includes all components, screened and solder-masked PC board, 2K bytes of RAM, a 2716 programmed with utility library and 150 pages of documentation ($25, separately). Octagon Systems Corp., 2849 West 35th Ave., Denver, CO 80211. (303-458-1705).

See List of Advertisers on page 210

An elegant solution to unscramble word puzzles. For the PET, Apple or TRS-80.

Popping and Pushing Permutations in BASIC

By Kenneth Wasserman

A permutation of a sequence of objects is a rearrangement of their order. Occasionally, when writing a program, one needs to compute all possible permutations of a group of objects. Most people with some mathematical background will know that given N objects there will be N! (read as N factorial, representing the product N × (N−1) × (N−2) × .... × 2 × 1) ways of permuting a given sequence. However, when it comes to explicitly listing all these N! sequences, people are often hard-pressed to come up with a general algorithm.

Some Motivation

Why, you might ask, would anyone want an exhaustive list of all possible arrangements of a series of objects? Edward Rager, in his article entitled "Scramble" (*Microcomputing*, January 1981, p.78), provides a program to assist the user in solving anagram puzzles, words or phrases whose letter or word positions have been rearranged to mask their true spelling or meaning. He suggests that his program is of great help in unscrambling such puzzles often presented in the game sections of newspapers. His program will output all possible letter permutations of any word given as input, providing that the word has either three, four, five or six letters. The restrictions on word length arise because each word length is treated by a separate subroutine in BASIC. To handle the four cases of different-length words, Rager needs to use about 80 BASIC statements, not counting input, output or remarks.

This article will present a more general algorithm that uses only seven BASIC statements.

Rager's general strategy is to use brute force in listing all permutations of three-letter words, and to use this subroutine as the *kernel* for longer words. That is, a four-letter word is handled by removing the first letter and permuting the remaining three by use of the "brute force" subroutine. Then the second letter is removed, and the new group of the three remaining letters is permuted. Next the third letter is held back, and again the three-permutation is done. Finally, the last letter is removed, and the first three letters of the original word are permuted.

At each stage the letter held back is concatenated to the front of each three-letter permutation before it is printed. Words five letters long are treated in a similar manner, except that the routine just described for four permutations is called after each one of the initial five letters is removed. Again, the letter is first stuck onto the front of the four-permutation before it is printed. Six-letter words are similarly permuted.

An Elegant Solution

The basic concept embodied in Scramble is central to the functioning of a recursive program; that is, the solution to a problem by the use of a program segment which calls itself as a subroutine. To avoid a seemingly infinite number of subroutine calls, a recursive program usually has a conditional statement that checks to see if some base level has been reached. If this base level is reached, then a return from a subroutine statement is executed, avoiding an infinite recursion.

In Scramble, this base level is a word that is three letters long. However, this program is not recursive in that each different-length word is initially handled by a separate subroutine; thus, no part of the program calls itself as a subroutine.

Unfortunately, the BASIC language does not allow truly recursive subroutines. This stems from the fact that all variables are global; that is, they are known to all parts of the program at all times. A recursive subroutine should allow for local variables known only within the subroutine and known only at one particular level in the recursion. The concept of a level of recursion is very useful if one wants to simulate a recursive routine in BASIC. To understand the idea of a level of recursion, as applied to the permutation problem, you can think of the length of the word that is

Address correspondence to Kenneth Wasserman, 154 W. 70th St., Apt. 6E, New York, NY 10023.

being permuted as the level of recursion.

For example, if you wanted to use a recursive procedure to find all permutations of the word CAT, you would start at level 3. You would remove each letter and call the permutation procedure with the "words" AT, CT and CA. Each of these two-letter words would be processed at level 2 in the procedure. In level 2 you would call the permutation subroutine at level 1 with the word A and then with T for the word AT. You would do a similar call with C, T and C, A for the words CT and CA, respectively. Finally, in level 1 each word would simply cause a return of itself. Level 1 is the base level so that it defines the enumeration of permutations of a one-letter word as only that single letter.

After reaching level 1, the procedure pops back up to level 2, where the letter that was removed is concatenated onto the front of the word. The second letter of the word at level 2 is then removed and you push down to level 1, which then pops back up to level 2, where the removed letter is stuck onto the front of the single-letter word. Having finished both letters of the word at level 2, the procedure pops up to level 3 and proceeds with processing the next letter of the three-letter word, CAT. When all processing is complete at level 3, it finally pops back up to the main program, which called the permutation procedure in the first place.

All this pushing and popping suggests that a pushdown stack is a good way to implement recursive routines. Stacks are easy to handle in BASIC, and are thus what I will use to write this recursive routine. A stack is most easily implemented with a one-dimensional array and a stack pointer or simply an index into the array. Thus, if you call the stack I and the stack pointer L, you can locate the next stack entry by I(L). To add an entry on the stack you use L = L + 1, then I(L) = entry. To remove an entry you use entry = I(L) and assign L = L − 1.

How to Do It

You are now ready to describe permutations, a simple routine in BASIC for enumerating all possible permutations of a given word of unrestricted length. This program was written in PET BASIC and works equally well on an Apple or TRS-80 (see Program listing). Lines 1000 through 1060 contain the permutation subroutine that does all the work.

Only three variables are used by the subroutine. The variable L serves a dual purpose; it indicates the level of recursion as well as the length of the word at that level. I(L) is the pushdown stack (described above) used to indicate what letter, at the current level of recursion, is to be removed from W$(L). W$(L) is the word to be permuted at level L. W$ is a variable used to hold the top level word needed by the print subroutine at line 2000.

The subroutine must be called with L set equal to the length of the word you wish to permute and with W$ equal to W$(L), the word itself. Line 1000 checks to see if the base level of the recursion has been reached. If it has, the subroutine at line 2000 is called and the procedure pops back up to the next-higher level. Otherwise it sets up a FOR. . . NEXT type loop between lines 1010 and 1060.

The counter variable I(L) is initialized to L in line 1010. Line 1020 inserts the letter currently being removed at level L into the proper place in W$. Line 1030 forms the word to be permuted at the next lower recursive level. The actual recursive subroutine call occurs in line 1040. Note that you must explicitly decrement and later increment the value of L, because all variables are global in BASIC and you need a way of keeping track of the current level.

Lines 1050 and 1060 finish off the FOR. . . NEXT type loop by decrementing the loop counter, I(L), and checking for termination. If the loop at level L is finished, the procedure returns to the next higher level; otherwise it goes to line 1020 and removes the next letter.

The only operator used which might vary among versions of BASIC is the MID$ function. When given three arguments, MID$ will return the substring of the first argument starting at the position specified by the second argument with a length given by the third argument. However, when only two arguments are given to MID$, it will return the substring of the first argument, starting at the position specified by the second argument and continuing until the end of the original string. If your version of BASIC does not have this feature, it should be easy enough to simulate using the LEN (length) function.

Hopefully, the user will find many other applications for this procedure and the techniques it uses. One possible application involves analyzing playing card hands for numerical sequences, as in poker or cribbage. All possible orderings can be generated and a simple check of each will determine if a beneficial sequence exists within the hand.■

```
10 REM  PERMUTATIONS BY KENNETH WASSERMAN 3/12/81
20 :
30 REM  THIS PROGRAM WILL LIST ALL POSSIBLE PERMUTATIONS OF THE WORD GIVEN AS
40 REM  INPUT.  A RECURSIVE SUBROUTINE IN LINES 1000-1060 PRODUCES THE NEXT WORD
50 REM  TO BE OUTPUT.  THE SUBROUTINE IN LINES 2000-2050 CAN BE USED TO SIMPLY
60 REM  PRINT THE REARRANGED WORD OR IT CAN BE EXTENDED TO REQUEST FURTHER
70 REM  ANALYSIS ON THE WORD PRESENTED TO IT.
80 :
100 INPUT W$
110 L=LEN(W$)
120 DIM W$(L),I(L)
130 W$(L)=W$
140 GOSUB 1000
150 END
999 :
1000 IF L=0 THEN GOSUB 2000: RETURN
1010 I(L)=L
1020 W$=MID$(W$,1,L-1)+MID$(W$(L),I(L),1)+MID$(W$,L+1)
1030 W$(L-1)=MID$(W$(L),1,I(L)-1)+MID$(W$(L),I(L)+1)
1040 L=L-1: GOSUB 1000: L=L+1
1050 I(L)=I(L)-1: IF I(L)=0 THEN RETURN
1060 GOTO 1020
1999 :
2000 REM  THIS SUBROUTINE IS PASSED A WORD IN THE VARIABLE W$.  NOTE THAT W$
2010 REM  IS A PERMUTATION OF THE ORIGINAL WORD INPUT TO THIS PROGRAM.  ITS
2020 REM  VALUE SHOULD NOT BE CHANGED BY THIS SUBROUTINE.
2030 :
2040 PRINT W$,
2050 RETURN
```

Program listing. The Permutations program was written in BASIC on a Commodore PET, but it will run "as is" on an Apple II with Applesoft. It will also run on a TRS-80 with Level II BASIC if you add the following line:
90 CLEAR 1000
If you want to check the permutations of a ten-letter word, plan on spending a few days in front of your computer's display—there are 3,628,800 permutations to watch.

If you're a prospective computer buyer who's tired of hearing about "the other guys," Intertec offers you another choice which is worth considering.

The Secret World Of the Superbrain

By Lawrence J. Bregoli

When I started in 1976 as a hardware hacker, I never thought I would own a machine as powerful as the Superbrain. In those days 1K bytes of 2102 RAM and a hex display were all that anyone could ask for. Today I can pick up a phone and order a full system which can be delivered within the week. Which is exactly what I did.

I started with some basic criteria. First, I wanted a system that wasn't strung together with cables and expansion boxes. Second, I wanted built-in disks and a proven operating system. Finally, I wanted a system that would accept Microsoft BASIC.

I had just about chosen the Superbrain when Tandy unveiled the Model III. Both computers sounded as if they were what I was looking for. I took the trip to a nearby Radio Shack computer store.

There it was sitting on the shelf—the Model III with dual disks, Microsoft BASIC and TRSDOS. What more could you ask for? I wanted to tuck it under my arm and leave, and the salesperson knew it.

Then he turned it on. It couldn't be true—a 64 character by 16 line format, just like the Model I. I had expected an 80 by 24 format.

It was then that I decided. Since I wanted my system for text writing and editing, I felt that I needed an 80-character format. I placed my order for the Superbrain.

Vital Stats

Since I had never used a CP/M operating system, I had a few fundamentals to learn. The first two chapters of the manual give a brief overview of the hardware. Its vital statistics include:

- The Superbrain uses two Z-80 microprocessors, one for computing and screen functions and one for disk I/O. Both operate at 4 MHz.
- Two types of disks are available: single-sided double-density and double-sided double-density (quad density). They hold over 350K and 700K bytes respectively.
- Two memory sizes, 32K bytes and 64K bytes, are available.
- The display size is 80 characters by 24 lines, with upper- and lowercase displayed in a 5×7 matrix on a 7×10 field. A 15 MHz CRT is used.
- There are two built-in RS-232 asynchronous serial ports and a 40-pin Z-90A data bus. Intertec sells an optional S-100 adapter for this bus.
- The main 62-key keyboard has a standard character set plus an alpha caps-lock, backspace, linefeed, break, delete, escape, here is, control, return and a set of reset keys which must be pressed at the same time to cause a system reset. An 18-key numeric keypad has its own enter key and four cursor control keys.
- The operating system is CP/M version 2.2.

System Programs

The programs provided on the original diskette are shown in Table 1. Some of the programs unique to the Superbrain include 32CPM5/1, 32CPM5/5, 64CPM5/1 and 64CPM

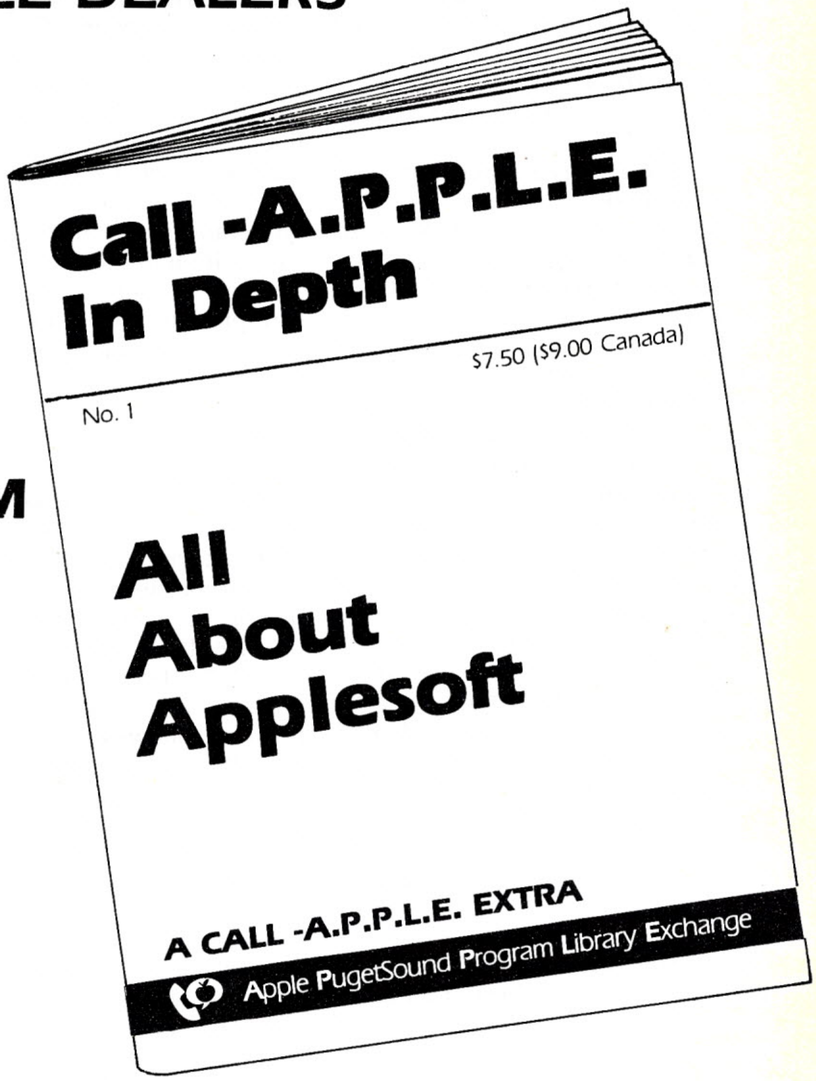
Intertec's Superbrain QD features a double-sided drive system for over 700K bytes of disk storage and a full 64K of RAM.

Address correspondence to Lawrence J. Bregoli, 106 S. Longyard Road, Southwick, MA 01077.

NOW AVAILABLE!

IN DEPTH

AT SELECTIVE APPLE DEALERS WORLD-WIDE



136 pages of timeless reference material on heavy duty stock.

- **APPLESOFT FROM BOTTOM TO TOP**
- **APPLESOFT INTERNALS**
- **PROGRAM SPLITTER**
- **AMPLIFYING APPLESOFT**
- **HI-RES NOTES**
- **and more**

Dealer Inquiries Invited

Membership and dealer information:

Apple Pugetsound Program Library Exchange
304 Main Ave. S., Suite 300-M
Renton, WA 98055
(206) 271-4514

See List of Advertisers on page 210

5/5. All are different operating systems for use with 32K and 64K machines. The two programs ending in /1 are used to convert programs created on earlier versions of the Superbrain to the present system. The only one of the above programs I use is 64CPM5/5, to put the operating system on a newly-formatted diskette.

The programs 32K TEST and 64K TEST are memory exercise tests to verify that the RAM is okay.

The FORMAT program does what it implies—formats new diskettes.

The TX and RX programs are used to transmit serial data through the RS-232 ports. The program TX/RX.-DES is a description of the TX and RX programs.

SYSTEM.DES is a Superbrain DOS 3.0 description.

The program 32BS5/5.ASM is an assembly-language program which can be used to modify the BASIC I/O system.

The CONFIGUR.COM program lets you configure the main and auxiliary RS-232 ports to match the Superbrain to a peripheral piece of equipment. CONFIGUR allows you to set the baud rate (up to 9600 baud), number of character bits, number of stop bits and parity status for either port, and also handshaking on the auxiliary port.

You may also configure the disk system to allow disk read-after-write verification. After making your changes, a new operating system is written onto your disk until you need to configure again.

The rest of the CP/M programs make Superbrain a powerful machine for assembly-language programming and file handling.

My favorite computer-based language, however, is BASIC, and Microsoft BASIC is the best of all those available. So after backing up and properly labeling my MBASIC5 diskette, I was ready to get started.

(By the way, to run MBASIC5 on the Superbrain you need a 64K system. While Microsoft was packing all that power into MBASIC5, they made the interpreter 26K long. With this and a 12K monitor there's just not enough room in a 32K machine. With 64K you wind up with 28187 bytes of available program space, which is enough for most programming needs. If you need more room, MBASIC5 makes it easy with the CHAIN command.)

The power of MBASIC5 has been discussed in several articles appearing previously in this journal. Some unique features of the Superbrain let you use MBASIC5 for some sophisticated programming. A few examples include:

Absolute cursor addressing. A BASIC statement of the type

```
100 PRINT CHR$(27)"Y"CHR$(ROW+32)CHR$(COL+32);
```

where ROW ranges between 0 and 23 and COL ranges between 0 and 79 will place the next print position anywhere on the screen. ROW=0 and COL=0 is the upper left-hand corner.

Erase to end of line. The statement

```
110 PRINT CHR$(27)CHR$(126)"K";
```

will erase data from the current cursor position to the end of the current line.

Erase to end of page. The statement

```
120 PRINT CHR$(27)CHR$(126)"k";
```

will erase data from the current cursor position to the end of the screen.

Combinations of the statements can provide some interesting split screen programming. One of my favorites is

BLINKING:

Using certain CHR$ codes in a BASIC program can make a character or group of screen characters blink. This feature can be used to make important portions of your displayed text or prompts blink on and off.

In BASIC, a statement of the type

```
200 PRINT CHR$(27)CHR$(126)"B";
```

turns on the blinking mode for any text that follows and

```
220 PRINT CHR$(27)CHR$(126)"b";
```

turns the blinking mode off. Any text printed to the screen between these two statements will blink, but the rest of the screen will have normal characters. Any text set in the blinking mode will remain blinking until it is scrolled off the screen.

Reverse video. For those of you who would rather look at black on a white background, you can reverse the video with an OUT command from BASIC. The statement

```
250 OUT &H68,&HC3
```

will reverse the video system to a white background, while the statement

```
260 OUT &H68,&H43
```

will set the video back to normal.

Display control characters. There are another 32 special characters corresponding to the control code values. They consist of arrows pointing in all four directions, plus two more arrows in the up-left direction and in the down-left direction. Other graphics included in this set are a small bell corresponding to the keyboard's CTRL"G" command and various other underlined numbers and letters, plus a set of up and down chevrons.

To get at these characters from BASIC you again use the CHR$ codes. The statement

```
300 PRINT CHR$(27)CHR$(126)"E";
```

will enable the transparent mode for these control characters. A following statement of the type

```
310 PRINT CHR$(X);
```

where X is between 0 and 31, will produce one of the control codes printed on the screen. If X falls between 128 and 160, the control codes will be displayed in the blinking mode.

Cursor Controls. As stated previously, the numeric keypad has a set of cursor control keys labeled with arrows in four directions. These keys plus the tab key on the standard keyboard are all functional under BASIC, and are handy for text editor programs. The break key is not allocated in BASIC and may be used in any fashion you wish under program control.

Conclusions

I have not covered all the features of the Superbrain. But I hoped to get across that other computers are out there. These computers offer many special features which a computer user may want or need in his application; we shouldn't ignore them because we don't read about them regularly.■

32CPM5/5	COM	64CPM5/5	COM	32CPM5/1	COM
64CPM5/1	COM	32KTEST	COM	64KTEST	COM
FORMAT	COM	32BS5/5	ASM	SYSTEM	DES
TX	COM	RX	COM	TX/RX	DES
CONFIGUR	COM	HEXDUMP	COM	SUBMIT22	COM
XSUB22	COM	ED22	COM	DUMP22	COM
ASM22	COM	LOAD22	COM	SYSGEN22	COM
STAT22	COM	PIP22	COM	DDT22	COM

Table 1. System diskette programs.

Sooner or later, as certain as death and taxes, you'll need to expand your system. Here's an inexpensive way to expand the memory of your Superboard II or Challenger C1P.

Poor Man's Memory Expansion for the OSI

By John E. Young

The Ohio Scientific Superboard II and Challenger C1P are excellent values for the money, giving you up to 8K memory, an 8K BASIC-in-ROM, cassette interface, 50 key upper and lowercase keyboard, and many other features on a single board. All you need to add is a TV or monitor and a cassette recorder, and you are up and running.

But as the saying goes, "Into every life some rain must fall." Expansion of this computer is a rather expensive proposition—the OSI 610 expansion board with an additional 8K memory is $300, a cost very nearly equal to that of the original computer system. The 610 board does have a number of other features—sockets and decoding for a total of 24K memory, peripheral interface adapter for use with disk drives and buffering of all signals for use with an expansion bus that can be purchased separately. But if you're interested only in expanding memory, the 610 board is too expensive.

Fortunately, I've found a very inexpensive way to add up to 16K additional memory. The interface board described here couples the new memory board to the OSI computer as well as a 44-pin bus, which will let you construct and add peripherals at minimum cost.

In addition, you can double the baud rate for the cassette interface, to improve the speed with which you can load programs or data into the expanded memory.

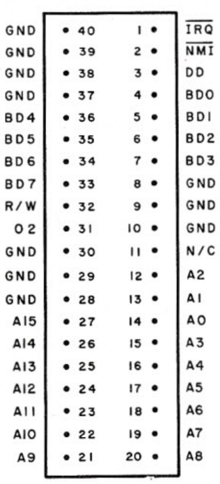


Fig. 1. Pin assignments for OSI 40-pin DIP socket.

Address correspondence to John E. Young, 6701 King Court, Woodridge, IL 60517.

OSI Expansion Capabilities

The main CPU board of the Superboard II/C1P (600 board) has a 40-pin DIP socket for connecting most peripherals that require parallel data. This socket provides output for the address, data and necessary control signals. The pin assignments for this socket are shown in Fig. 1.

The bidirectional data lines are buffered on the 600 board by means of 8T28 transceivers. The 600 board actually contains only the sockets for these two 8T28s; you must install these in the U6 and U7 positions to use the expansion connector.

The direction of data through the transceivers is controlled by the DD signal that is generated by whatever peripheral is using the data lines at any moment. More details regarding the DD signal will be presented later, in the discussion of the memory board and the interface circuits.

The 16 address lines, clock (Ø2), and read/write (R/W) signals are not buffered on the OSI 600 board, so buffers must be provided on an interface board. In addition, interrupt re-

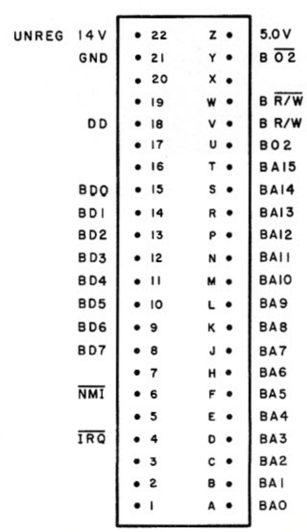


Fig. 2. Edge connector for 44-pin bus.

quest ($\overline{IRQ}$) and nonmaskable interrupt ($\overline{NMI}$) lines are included for CPU control by external peripherals. The socket is wired so that when a 40-conductor ribbon cable is connected to the socket, the clock and control signals Ø2, R/W, DD, $\overline{IRQ}$ and $\overline{NMI}$ are isolated from each other and the data and address lines by means of ground lines to minimize possible interaction among these signals. There is one unused pin in the 40-pin socket that could be used for some other signals as the need arises in the future.

These signals should provide for the fundamental needs of just about any peripheral you would attach to an expansion bus. Additional control signals can be synthesized as necessary, such as the two extra signals required by the memory board used in this expansion.

Bus Structure

To minimize cost, the bus is based on double-sided 22/44 pin sockets with 0.156 inch spacing. These connectors are readily available, either in solder or wire-wrap configuration. These sockets accept 4 × 4.5 inch hobby prototyping boards, which are quite inexpensive yet hold an adequate number of ICs if space is used efficiently. The interface between the OSI 600 board and the memory expansion board is constructed on one of these boards and fits into one slot of the bus.

The pin assignments for the bus are essentially the same used in KIM-type buses, but a number of the KIM control signals are omitted, since they are not available from the OSI 600 board. The pin assignments for the bus are shown in Fig. 2. Ø2 and $\overline{R/W}$ are not directly supplied by the OSI 600 board but are generated and buffered on the interface board and then supplied to the bus. There are a number of unused lines in the bus which can be used for specialized signals as peripherals are added to the system.

I have included both a 14-V unregulated and a 5.0 V regulated line on the bus. The 5.0 V line is controlled by the 7805 voltage controller powering the interface board. The interface board uses less than 200 mA of the 1500 mA capacity of the 7805, so if a peripheral board is constructed that contains a moderate number of ICs, it can be powered from the 5.0-V line. Otherwise, the peripheral should have its own voltage regulator powered from the 14-V unregulated line.

Memory Expansion Board

The memory board used in this system is a 16K static RAM board designed for the SS-50 bus (SWTP 6800 computer) and sold by Digital Research Corp. (PO Box 401565, Garland, TX 75040). Digital Research currently sells the bareboard for $30. This board uses 2114s, which can now be bought for about $4 each. All support components for this board are readily available and inexpensive ($2 for the most expensive chip). All told, you can buy and assemble this board with 8K memory for $100–$125, and when you add the cost of

Hex Code	Address Line Status 15	14	13	12	11	10
1FFF	L	L	L	H	H	H
2000(1)	L	L	H	L	L	L
3FFF	L	L	H	H	H	H
4000	L	H	L	L	L	L
5FFF(2)	L	H	L	H	H	H
6000	L	H	H	L	L	L
7000	L	H	H	H	L	L

(1) Starting address for 16K memory expansion
(2) Final address for 16K memory expansion

Fig. 3. Binary coding of high order address lines for hex 2000 to 5FFF.

the interface board and bus sockets, you still have laid out only about half the cost of the OSI 610 board.

The board has its own voltage regulators, so you need to supply at least 8 V of unregulated power. All data, address and control lines are directly available from the OSI 600 board (through appropriate buffers) with the exception of two—$\overline{\emptyset 2}$ and $\overline{VMA}$ (valid memory address). These signals are synthesized on the interface board.

The memory on the Digital Research board is addressed in 16K blocks starting from address 0000, 4000, 8000 or C000 hex. The 16K memory expansion for the OSI system must start at 8K (2000 hex) and end at 24K (5FFF hex), so the memory addressing scheme on the Digital Research board must be modified. The binary configuration of the high order address lines for the appropriate hex addresses is shown in Fig. 3. As can be seen from this chart, for the range of memory addresses of interest for the OSI expansion, either address line 13 or 14 is high. For addresses outside the critical range, lines 13 and 14 are either both low or both high. Hence an exclusive OR gate can be used to generate the $\overline{VMA}$ signal for the memory board. The schematic of the exclusive OR gate is shown in Fig. 4, which is actually installed on the interface board described later.

To complete the modified address decoding, the address selection jumpers normally used on the Digital Research board must also be changed. The selection is carried out by means of jumpers installed in an eight-pin socket on the memory board. Rather than using any of the configurations shown on the Digital Research instruction sheet, the scheme shown in Fig. 5 is used. Only one conventional jumper is used—between pins 2 and 7. Pin 4 is tied high by means of a jumper to somewhere on a regulated 5.0-V line.

Because of the modified address decoding, the first 8K of the 16K available of the board resides at the high end of the memory board. If you populate only half the memory board, the 2114s must be installed in sockets 9 through 16 and 25 through 32 rather than 1 through 8 and 17 through 24.

The data direct (DD) signal needed by the transceivers on the OSI 600 board is taken from the memory board by running a jumper from either pin 8 of IC 35 or pin 15 of ICs 38, 39 or 40 of the memory board to an unused spot on the 50-pin connector area at the edge of the board.

Rather than attach a plug-in connector to the edge of the memory PC board, I simply soldered two 16-conductor ribbon cables directly to the terminations at the board edge. At the other end of each of the ribbon cables is a standard 16-pin DIP connector. Hence the memory board is connected directly to the interface board by means of these cables, rather than going through the hassle of wiring up a single 50-pin edge connector dedicated to the memory board.

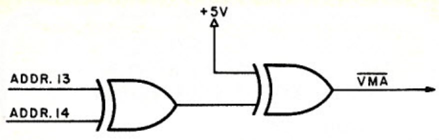


Fig. 4. Exclusive OR gate for generating $\overline{VMA}$ signal needed by memory board.

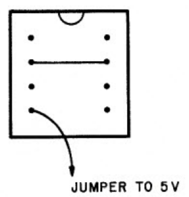


Fig. 5. Jumper configuration for memory address selection on the Digital Research memory board.

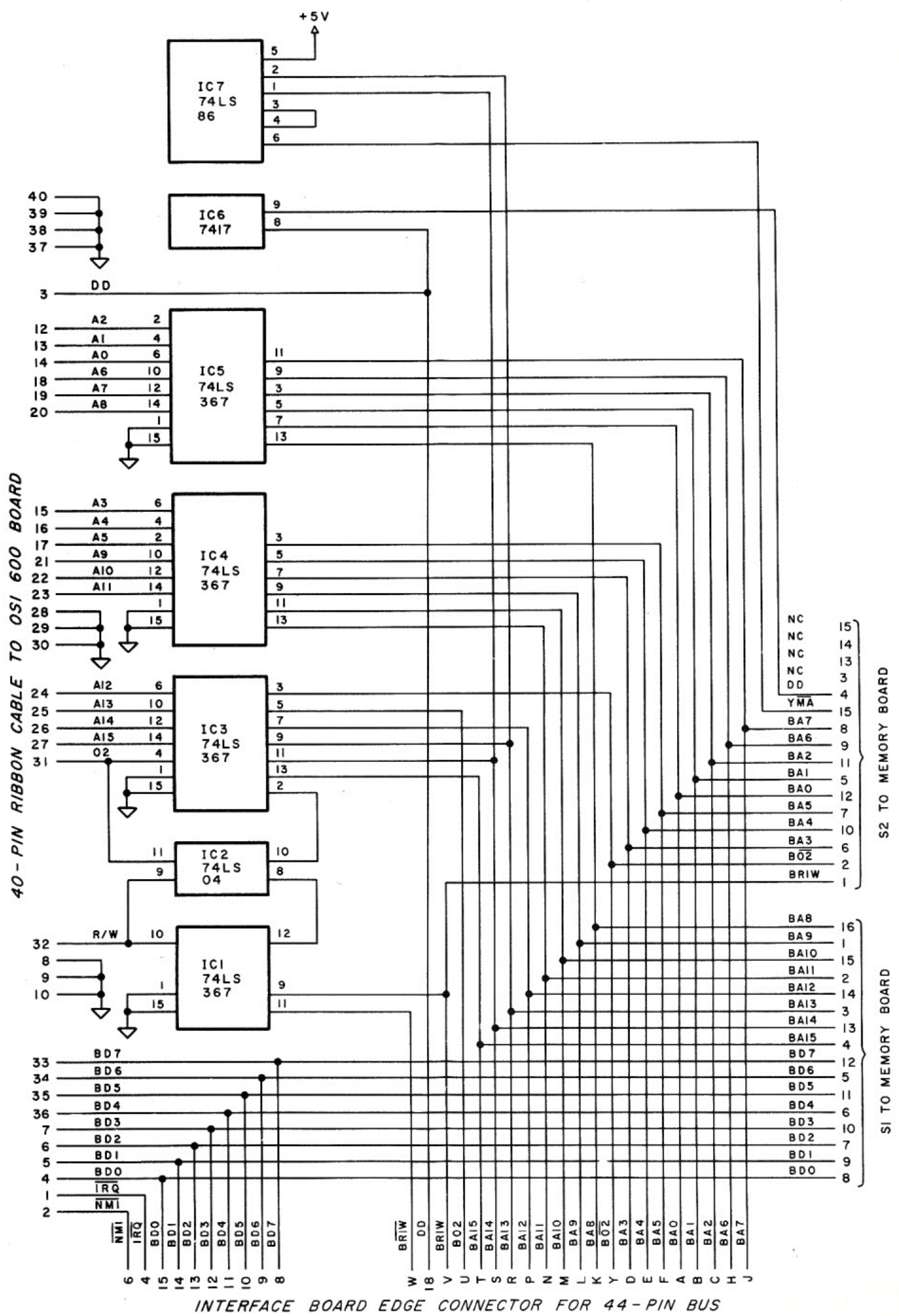


Fig. 6. Schematic of interface board.

Interface Board

This board supplies the signal buffering and modification necessary for both the memory board and the bus. The overall schematic of this board is shown in Fig. 6. 74LS367s are used for buffering of the address lines, R/W and Ø2. (OSI's R/W is equivalent to the Digital Research R/$\overline{\text{W}}$ signal.) There are four unused buffers in IC1 in case additional signals are brought into the bus or from the OSI 600 board. Since it was necessary to produce an inverted Ø2 for the memory board, the buffered $\overline{\text{Ø2}}$ is sent to the bus as well, in case any other peripheral requires $\overline{\text{Ø2}}$. An inverted read/write signal ($\overline{\text{R/W}}$) is also generated, buffered and sent to the bus. The exclusive OR gate necessary to generate the $\overline{\text{VMA}}$ signal for the memory board uses two of the four gates on a 74LS86.

This board contains the 40-pin DIP socket for the ribbon cable coming from the OSI 600 board, wired according to Fig. 1. Two 16-pin DIP sockets are wired according to Fig. 7 for the ribbon cables leading to the memory board. The connector sockets and interface ICs are all installed in the interface board using wire-wrap connections.

The data direct (DD) line tells the computer that a peripheral is putting valid data onto the bus. This line is held high by a voltage divider on the OSI 600 board and must be pulled low (sinking approximately 23 mA) by any peripheral transmitting to the bus. This can be done with a 7417, an open collector driver capable of sinking 40 mA.

With open collector drivers on each peripheral that supplies a DD signal, a high impedance path is presented to the bus unless it is pulled low by its own peripheral. In this way, current through the DD line and the drivers held in the low state is limited to the 23 mA supplied by the pull-up divider at the transceivers. The 7417 for the DD signal supplied by the memory board is located on the interface board.

The $\overline{\text{NMI}}$ and $\overline{\text{IRQ}}$ lines to the OSI 600 board are fed directly from the bus without intermediate drivers. OSI holds these lines high at the 6502 CPU chip with 4.7k resistors. Open collector buffers such as the 7417 should be used in this case also, since there will be a possibility of multiple peripherals driving one or the other of these interrupt lines.

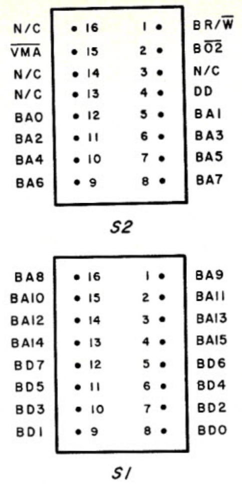


Fig. 7. Sockets for two 16-conductor ribbon cables to memory board.

General Construction Considerations

The complete system is constructed in a box 8×12×6 inches. This box contains a seven-slot bus and the memory board, which is attached to spacers along one side of the box. Unregulated 14 V dc is supplied to the box from a separate 10-amp power supply. The edge connectors for the bus are mounted on 3/4×3/4 inch aluminum angles that run from end to end of the box. I have used wire-wrap connectors for the bus. An inexpensive 22/44-pin motherboard is available from Electronic Systems in San Jose, CA, that would simplify wiring of this bus.

Now that you have significantly expanded your memory from 8K to 16 or 24K, you will quickly realize that loading that much data or program material from cassette tape at the Kansas City standard of 300 baud takes ages! You can easily cut that time in half with a very simple modification to the OSI 600 board.

OSI uses a 6850 asynchronous communications adapter for control of serial data. The transmit clock (pin 4) and the receive clock (pin 3) inputs of the 6850 are tied together on the PC board and driven by output from the clock counter. The trace on the PC board must be cut just beyond where the pins 3 and 4 are tied together. Leads are then soldered to each cut end of this trace and run to the prototype section of the board.

In this section of the board, I placed a 16-pin socket and a 74LS151 multi-

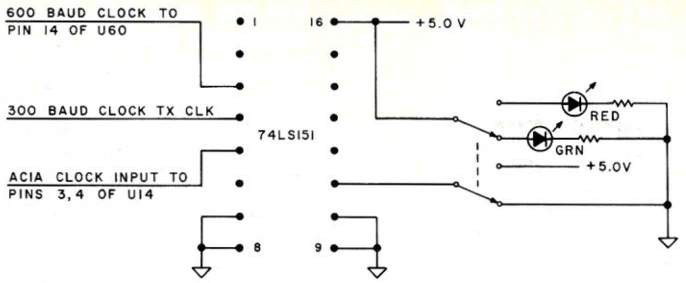


Fig. 8. Baud rate selector and indicator.

plexer. The multiplexer is used to avoid putting the clock pulses directly through the switch. Direct switching of the clock signals may not lead to problems, but this is a simple, yet elegant, way of doing the job. The clock signal for the 600 baud rate is obtained from pin 14 of U60. The switch then ties one select input on the multiplexer either high or low.

The wiring scheme is shown in Fig. 8. The output of the multiplexer (pin 5) is connected to the clock input of the 6850 (pins 3, 4). The 300-baud clock input, taken from the other end of the cut trace (actually called the TX CLK signal), is input to pin 4 of the multiplexer. The 600 baud clock signal is input to pin 3. The enable signal (pin 7) and select lines 1 and 2 (pins 9 and 10) of the multiplexer are grounded. Select line 0 (pin 11) of the multiplexer is wired to one pole of a DPDT miniature toggle switch mounted on the front panel of the computer next to the keyboard. I added indicator LEDs—a green one for the standard 300 baud and a red one for 600 baud.

I did not have to change the capacitors in the cassette audio input section for use with 600 baud. Because I wanted to preserve the standard 300-baud operation in order to use commercial software, I wanted to avoid having to make this change.

Operation in the 600-baud mode has been just as reliable as with the 300 baud, using a cheap cassette recorder and cheaper cassettes. Even at 600 baud, cassette read-and-write operations take a considerable amount of time for large blocks of information. I am currently investigating ways of improving this situation, without going to a disk system.

Conclusion

With this setup, I have doubled my system memory with the capability of adding yet another 8K, and have a six-slot bus structure that will permit considerable experimentation with peripherals. All this has been obtained for half the cost of the OSI expansion board. Types of peripherals that I envision constructing for my bus are a multichannel A/D converter for home monitoring, ac switching gear for home control and sound or music boards. OSI now has these types of options available in their larger computer systems, but all that is at a price. Besides—it's more satisfying to know that you've done it yourself.■

NEED A PRINTER?

UP TO 25% DISCOUNTS! — SAME DAY SHIPMENT!

CENTRONICS 739

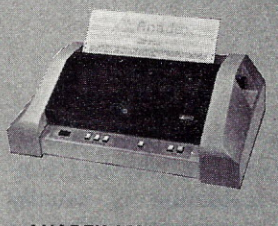
With Graphics and Word Processing Print Quality

• 18 x 9 dot matrix; suitable for word processing • Underlining • proportional spacing • right margin justification • serif typeface • 80/100 CPS • 9½" Pin Feed/Friction feed • Reverse Platen • 80/132 columns • Top of form

CENTRONICS 739-1 (Parallel) .... (List $955) **$725**
CENTRONICS 739-3 (Serial) .... (List $1045) **$815**
GRAPPLER™ Apple graphics interface **$165**

ANADEX

Dot Graphics, Wide Carriage

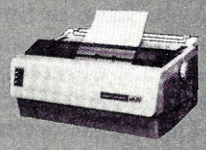


• 11 x 9 dot matrix; lower case descenders • Dot resolution graphics • Bi-directional, logic seeking • Up to 200 CPS • RS 232 Serial & Parallel • Forms control • X-ON/X-OFF • Up to 6 part copy.

ANADEX 9501 .... (List $1650) **$ Call**
GRAPPLER™ Apple graphics Interface .... **$ 165**

C. ITOH STARWRITER

Daisy Wheel Letter Quality



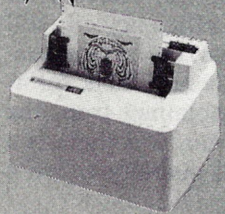
• 25 CPS (Optional 45 CPS) • Typewriter quality • Centronics parallel • RS 232 Serial (Optional) • Proportional spacing • Bidirectional • Programmable VFU • Self test • Diablo compatible • Friction feed (Optional tractors) • 136 printable columns • Manufactured by TEC.

C. ITOH STARWRITER .... (List $1895) **$1525**

SUPER PRICES

IDS PAPER TIGERS

Dot Resolution Graphics, quality print, speed

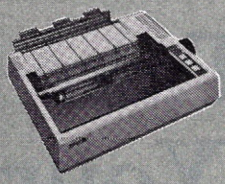


9 wire printhead (460) with lower case descenders • Over 150 CPS • bi-directional, logic seeking • 8 character sizes; 80-132 columns • Adjustable tractors • High-resolution dot graphics • Proportional spacing & text justification

IDS 460G 9 wire printhead, graphics .... (List $1094) **$Call**
IDS 560G wide carriage, graphics .... (List $1394) **$Call**
GRAPPLER™ Apple graphics interface **$165**

EPSON MX80/MX70/MX100

Low-Priced Professional Print Quality



• 9 x 9 dot matrix • Lower case descenders • 80 CPS • Bidirectional, Logic seeking • 40, 66, 80, 132 columns per line • 64 special graphic characters: TRS-80 Compatible • Forms handling • Multi-pass printing • Adjustable tractors

We also carry a full line of Epson Accessories.

EPSON MX80 (& MX80FT) .... (List $645) **$Call**
EPSON MX70 Dot graphics, 5 x 7 matrix .... (List $450) **$Call**
EPSON MX100 wide carriage, graphics .... (List $945) **$Call**
GRAPPLER™ Apple Graphics Interface .... **$ 165**
GRAFTRAX 80 - MX80 Dot Graphics .... **$ 95**

MX80/70 FRICTION FEED KIT

User installable kit for single sheets.
Easy 30 minute installation .... $ 75

NEW

NEC 8023 DOT MATRIX

Dot graphics • 100 CPS • Bi-directional, logic-seeking • Tractors & friction feed • 5-Alphabet fonts • 8 character sizes • Proportional spacing

NEC 8023 DOT MATRIX .... (List $795) **$ Call**

NEC SPINWRITER

High Speed Letter Quality

• 55 CPS • Typewriter quality • Bidirectional • Plotting • proportional spacing.

7710 RO, Serial .... (List $3055) **$2575**
7730 RO, Parallel .... (List $3055) **$2575**

TELEVIDEO CRT'S

AT DISCOUNT PRICES!

QUANTITY PRICING AVAILABLE

TVI 910
TVI 912C
TVI 920C
TVI 950

Please Call Toll Free
Prices are too low to advertise

CRT'S

ADDS VIEWPOINT .... (List $ 699) **$ 600**

PRINTERS

MALIBU 165 wide carriage, graphics, letter quality (List $1975) **$1325**
QUME SPRINT 9 .... **$ Call**
DIABLO 630 .... **$ Call**
ANACOM 150 .... (List $1350) **$ Call**

INTERFACE EQUIPMENT

EPSON ACCESSORIES .... **$ Call**
ORANGE INTERFACE for Apple II parallel interface board & cable .... **$ 110**
TRS-80 CABLES to keyboard or Exp. interface .... **$Call**
NOVATION D-CAT direct connect modem .... **$ 180**
HAYES MICROMODEMS (Apple II) .... **$ Call**

CALL FOR INFORMATION & CATALOG

(800) 854-8275

CA, AK, HI (714) 630-3322

RETAIL PRINTER STORES:

Store #1	3150 E. La Palma, #I, Anaheim, CA	(714) 630-3622
Store #2	13604 Ventura Bl., Sherman Oaks, CA	(213) 501-3486

Store Hours: M-F 10-6 Sat. 10-4

Orange Micro inc. 310

3150 E. LaPalma, Suite G, Anaheim, CA 92806

"The Computer Printer Specialists"

Phone order WELCOME; same day shipment. Free use of VISA & MASTERCARD. COD's accepted. Manufacturer's warranty included on all equipment. Prices subject to revision.

Do your part for the energy conservation movement. Give your home a thorough energy analysis with this BASIC program that you can easily convert to your system.

Take a Byte Out of Your Energy Bills

By Paul J. Boudreaux

Sooner or later everyone gets infuriated when he finds that the local utility company plans to raise their rates again. This time I decided to dig out my old bills to see just what had been done to me over the last few years.

After assembling the records it occurred to me that there was more here than met the eye. As a practicing experimental research physicist, I recognized that this was a record of the energy used by my house for the past several years which reflected the local environmental stresses for each month. I also knew that to maintain a thermal balance in the home, the total energy put into the house had to equal the total energy flowing out of the house. Here then was a way of directly measuring the heat flow and the thermal resistance of my insulation and weatherproofing.

Thus, by using my utility bills, I wrote a BASIC program for my F8 system that will determine the effective insulating capability, or R-value, of my house. The 9K floating-point BASIC version used on my homebrew F8 system was by Micro Business Systems, Inc., Box 8255 JFK Sta., Boston, MA 02114, who used the Fairchild FAIRBUG PSU ROM chip.

Paul J. Boudreaux (Laboratory for Physical Sciences, 4928 College Ave., College Park, MD) is a senior research physicist specializing in the reliability and device physics of semiconductors.

The thermodynamics of home energy is complex and far beyond the scope of this article, but certain simplifications can be made.

Heat flow takes one of three forms: radiation (e.g., sunlight striking the roof), convection (e.g., hot air rising up a chimney) and conduction (e.g., the flow of heat through a wall). Although radiation and convection play important roles in the energy balance of a house, I'll concentrate on conduction.

Since conduction is generally the major heat-flow mechanism in the house, this simplifies things enormously. In this model, the relationship between conduction heat flow (H) and environmental temperature (T) is expressed as equation 1 in Table 1. H is expressed in British thermal units (BTUs), or the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

The inside and outside temperature difference is expressed by (Tin-Tout). A is the cross sectional area through which the heat flows and L is the length that it must travel.

K is a constant of proportionality called the thermal conductivity. In the English system used in the U.S., K is numerically equal to the number of BTUs of heat energy conducted in one hour through a slab one inch thick and one square foot in cross section when the temperature difference between the faces of the slab is one degree Fahrenheit (F).

Although the K value of any insulation can be found in physical constant tables, insulation is usually measured by a quantity called its R-value. The R-value of a material is simply its thickness in inches divided by the thermal conductivity. Thus, part of equation 1, K/L, is given for any particular piece of insulation by the reciprocal of its R-value. To determine the R-value, you have to find the total area of insulation in square feet and the temperature difference between the inside and outside of the house in degrees Fahrenheit occurring for one hour. This is shown as equation 2 in Table 1, and forms the basis for the program shown in Listing 1.

Knowing all these facts would be great if I were taking a high school physics exam, but I'm really after home insulation efficiency. I still need a measurement of the temperature during the month. This information could be obtained from the local TV weatherman, but there is a much more useful quantity called a "degree day."

$$H = \frac{KA}{L}(\text{Tin-Tout}) \quad \text{Equation 1}$$

$$H = \frac{A}{R}(\text{Tin-Tout}) \quad \text{Equation 2}$$

Table 1.

Listing 1. BASIC Home Insulation Efficiency program.

```
5 RESTORE
10 DIM D$(72)
20 DIM M$(36)
40 DIM T$(55)
50 DIM V$(80)
60 DIM Y$(4)
70 DIM X$(66)
76 DIM E(12,9)
77 DIM G(12,9)
78 DIM H(12,9)
79 DIM F(12,9)
80 DIM T(12)
110 DIM P(12,9)
120 DIM Q(12,9)
140 REM A IS EXTERIOR AREA IN SQ.FT.
142 A=3375
144 REM Y0=BEGIN YR, Y1=END YR
148 Y0=1973
149 Y1=1980
150 V$="  ELECT. (KWH X   GAS (THERMS X   ENERGY (KWH X HEAT+COOL(D.D.X "
151 V$=V$+"( BTU/DEG.DAY X "
160 T$="ELECTRICITYNATURAL GASTOT. ENERGYDEGREE DAYSEGY/DEG.DAY"
170 M$="JANFEBMARAPRMAYJUNJLYAUGSEPOCTNOVDEC"
180 X$="I----I----I----I----I----I----I----I----I----I----I----I----I"
200 REM 1GAL #2 OIL=1.4THERM, 1THERM=100000BTU=29.302KWH
210 REM 1 KWH = 0.034127 THERM
218 T=0
220 FOR M=1 TO 12
230 READ T(M)
235 T=T+T(M)
240 NEXT M
250 L=10000
260 O=10000
300 FOR Y2=Y0 TO Y1
310 Y=Y2-INT(Y2/10)*10
320 FOR M=1 TO 12
330 READ E(M,Y),F(M,Y)
340 NEXT M
350 NEXT Y2
355 J=0
358 J0 = 0
360 PRINT"DO YOU HAVE ELECTRIC HEATING FOR YOUR HOME? (YES OR NO)";
370 INPUT Y$
375  IF Y$(1,1) = "Y" THEN J0 = 1
380 IF Y$(1,1)="Y" THEN 485
382 PRINT"DO YOU HAVE OIL HEATING FOR YOUR HOME? (YES OR NO)";
384 INPUT Y$
386 IF Y$(1,1)="Y" THEN J=1
400 FOR Y2=Y0 TO Y1
410 Y=Y2-INT(Y2/10)*10
420 FOR M=1 TO 12
430 READ G(M,Y),H(M,Y)
435 IF J=1 THEN G(M,Y)=1.4*G(M,Y)
440 NEXT M
450 NEXT Y2
482 IF J=1 THEN T$(12,22)="HEATING OIL"
484 IF J=1 THEN V$(17,32)="  OIL (THERMS X "
485 PRINT
730 PRINT
740 PRINT"            YEARLY COST OF UTILITIES ($ DOLLARS )"
750 PRINT
760 PRINT"YEAR",T$(1,11),T$(12,22),T$(23,33);"   COST/DEG./DAY"
765 PRINT
766 P=0
767 Q=0
770 FOR Y2=Y0 TO Y1
780 Y=Y2-INT(Y2/10)*10
790 C=0
800 F=0
820 H=0
830 FOR M=1 TO 12
835 READ Q(M,Y),P(M,Y)
840 H=H+H(M,Y)
850 F=F+F(M,Y)
870 C=C+P(M,Y)+Q(M,Y)
875 P=P+P(M,Y)
876 Q=Q+Q(M,Y)
880 NEXT M
890 PRINT Y2,F,H,F+H,(F+H)/C
900 NEXT Y2
920 U1=0
930 PRINT
935 PRINT
940 PRINT"U IS THE AVE. BTU/(DEG*HR*SQ.FT.). R = 1/U"
941 PRINT"T IS THE AVERAGE MONTHLY TEMPERATURE OVER 30 YEARS"
942 PRINT
943 PRINT"           U               R            T"
944 PRINT
950 FOR M=1 TO 12
951 U=0
952 FOR Y2=Y0 TO Y1
953 Y=Y2-INT(Y2/10)*10
954 E1=.5
955 E2=.5
960 U=U+(E(M,Y)*E1*.034127+G(M,Y)*E2)*100000/((P(M,Y)+Q(M,Y))*A)
965 NEXT Y2
966 U=U/(24*(Y1-Y0+1))
970 PRINT M$(3*M-2,3*M);"     ";U;"          ";1/U;"          ";T(M)
980 U1=U1+U
990 NEXT M
1000 PRINT
1010 PRINT"THE AVERAGES FOR ";Y0;" TO ";Y1;" ARE:"
1020 PRINT"            U = ";U1/12
1025 PRINT"            R = ";12/U1
1030 PRINT"            T = ";T/12
```

More

The concept of a degree day is based on the fact that the fuel used to keep a building interior heated to 70 degrees F is proportional to the number of hours that the outside temperature is below 65 degrees F. Heating-fuel suppliers developed this concept further to predict their customers' needs and thereby keep their reserves adequate.

For the purpose of our calculation, a degree day is the difference between the daily mean temperature and 65 degrees F. It is always a positive number. Each degree of mean temperature below 65 degrees F is one heating degree day. Weather stations measure the hourly temperature and calculate the average daily temperature by adding them together and dividing by 24. They use this mean temperature to determine the degree day value.

A simpler method is sometimes employed which uses the median temperature instead of the mean. The median temperature of a day is the halfway point between the highest and lowest temperature existing during a 24-hour period. For example, if the highest temperature during the day were 42 degrees F and the lowest 18 degrees F, the median would be $(42+18)/2=30$, and the degree day entry would be $(65-30)=35$. This concept is so important that all U.S. weather stations record daily, monthly and seasonal totals.

Since we are concerned with the consumption of heating fuel, days during the heating season when the mean temperature does not drop below 65 degrees F are ignored in the cumulative totals for heating degree days. In a similar manner, cooling degree days are those for which the mean temperature is above 65 degrees F, and for which cooling energy loads are evaluated.

The National Weather Service collects and records both heating and cooling degree days for most locations in the U.S. This data for your local area, along with a 30-year average for the monthly temperature, is available annually from the National Oceanic and Atmospheric Administration (NOAA). The pamphlet is called the "Local Climatological Data Annual Summary with Comparative Data," 1981 (*specify your local area*). They will also supply an additional pamphlet called "Heating and Cooling Degree Day Data, Environment Information Summaries C14." It's useful if you want to learn more

Listing continued.

```
1040 PRINT"AVE # HEATING DEGREE DAYS PER YEAR = ";Q/(Y1-Y0+1)
1050 PRINT"AVE # COOLING DEGREE DAYS PER YEAR = ";P/(Y1-Y0+1)
8000 PRINT
8010 PRINT
8020 PRINT"DATA KEY:"
8030 PRINT"          + = SINGLE DATA POINT"
8040 PRINT"          * = MULTIPLE DATA POINT"
8050 PRINT"          # = MONTHLY AVERAGE"
8060 PRINT"          < = BELOW RANGE"
8070 PRINT"          > = ABOVE RANGE"
8900 FOR I=0 TO 4
8910 IF I=0 THEN W=50
8920 IF I=1 THEN IF J=0 THEN W=5
8922 IF I=1 THEN IF J=1 THEN W=10
8924  IF I = 1 THEN  IF J0 = 1 THEN 9260
8930 IF I=2 THEN W=250
8940 IF I=3 THEN W=50
8950 IF I=4 THEN W=2000
8990 FOR K=1 TO 5
8991 PRINT
8992 NEXT K
9000 PRINT"                   ";T$(I*11+1,(I+1)*11);" USED PER MONTH"
9010 PRINT
9020 PRINT V$(I*16+1,(I+1)*16);
9021 PRINT W/5;") 75    100       150       200       250       300"
9030 PRINT"        ";X$
9040 FOR M=1 TO 12
9050 D0=0
9060 N=0
9070 D$="                                                          "
9075 Z=1
9080 FOR Y2=Y0 TO Y1
9081 Y=Y2-INT(Y2/10)*10
9089 IF I = 4 THEN  IF J0 = 1 THEN O = 0
9090 IF I=0 THEN E=E(M,Y)
9100 IF I=1 THEN E=G(M,Y)
9102 IF I=2 THEN E=G(M,Y)*29.302+E(M,Y)
9104 IF I=3 THEN E=P(M,Y)+Q(M,Y)
9105 IF I=4 THEN E=((E(M,Y)-L)*.034127+G(M,Y)-O)*100000/(P(M,Y)+Q(M,Y))
9106 IF E=0 THEN 9180
9107 IF I=1 THEN IF O>=E THEN O=E
9108 IF I=0 THEN IF L>=E THEN L=E
9110 D1=E/W
9115 IF D1<1 THEN D$(1,1)="<"
9116 IF D1<1 THEN 9175
9120 D=INT(D1)
9125 IF D>65 THEN D=65
```

More

about degree days.

The above documents, and a number of other pamphlets, are available from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data and Information Service, National Climatic Center, Federal Building, Ashville, NC 28801, for a $3 postage and handling charge. Very often the public library has these or equivalent publications which contain this information. The local TV station forecaster is also a good source.

Although these temperatures-only techniques are satisfactory, they don't take into consideration the unique environmental conditions of your home, such as the number of hours of sunshine, wind speeds, house orientation and deciduous trees. However, these parameters are included in each month's evaluation simply by their presence in the utility bill, and thus in the effective R-value for the whole house. Equation 2 of Table 1 shows that if you know the total heat input (H) used by the house for a month (i.e., heating bill data) and the heating degree days for that

month (Tin-Tout) along with the exposed area of the house, you can evaluate the effective R-value.

What the Program Does

The program shown calculates the yearly cost of utilities and determines the energy cost per degree per day during that year. Next, the effective R-value for the house is evaluated for each month.

A monthly value is used because environmental changes alter the heat balance. For example, during the spring and early fall most people open their windows for fresh air. This conductivity model clearly breaks down during this transition period from heating to air conditioning or vice versa.

The program then prints five graphs. Electricity consumed per month over the years is plotted first. Heating fuel followed by total energy used (after suitable energy units have been converted) is next. The total number of heating plus cooling degree days is represented for each month during the years covered. The last plot is the monthly energy expended per degree per day.

Listing continued.

```
9126 IF D=65 THEN D$(D,D)=">"
9127 IF D=65 THEN 9175
9130 DO=DO+D1
9140 N=N+1
9150 IF D1-D >=.5 THEN D=D+1
9160 IF D$(D,D)<>" " THEN D$(D,D)="*"
9170 IF D$(D,D)=" " THEN D$(D,D)="+"
9175 IF D>=Z THEN Z=D
9180 NEXT Y2
9190 DO=INT(DO/N)
9200 D$(DO,DO)="#"
9205 PRINT"        I"
9210 PRINT M$(3*M-2,3*M);"   I";D$(1,Z)
9220 PRINT"        I"
9225 PRINT"        I"
9240 NEXT M
9250 PRINT"         ";X$
9260 NEXT I
10000 END
10001 REM AVE 30 YR MONTHLY TEMP
10010 DATA 32.7,34.8,43.3,53.9,63.2,72.2,76.7,75.5,68.7,57.0,46.2,36.6
10990 REM ELICTRICITY USAGE & MONTHLY COST
11000 DATA 0,0,0,0,440,14.59,800,22.67,740,21.31
11001 DATA 1650,42.74,2540,61.95,3180,76.43,2830,68.33,1830,46.85,860,25.10
11002 DATA 850,26.98,1000,30.10,890,29.53,810,29.63,820,31.82,910,34.30
11003 DATA 1660,60.83,2460,87.41,2160,80.94,2240,84.81,1230,50.13,780,34.01
11004 DATA 900,38.09,1060,41.93,920,37.69,960,37.60,820,33.25,790,32.57
11005 DATA 1560,60.83,2790,107.84,2660,102.49,2140,87.61,1090,48.10,890,39.49
11006 DATA 850,38.65,1110,46.76,990,42.56,930,42.39,850,39.52,980,42.73
11007 DATA 1270,57.76,2460,102.27,2730,100.76,1180,65.99,1110,51.06,800,38.42
11008 DATA 880,40.70,1080,46.60,990,49.56,820,43.14,800,42.31,620,33.54
11009 DATA 1270,66.94,2110,104.37,2170,109.54,2100,104.83,1060,57.29,710,38.00
11010 DATA 970,46.74,980,48.32,960,50.43,830,45.86,740,40.51,800,42.69
11011 DATA 1080,58.24,1760,98.69,2140,117.02,2300,121.88,1210,67.54,820,46.26
11012 DATA 940,50.78,1130,51.81,930,48.98,1090,54.77,760,42.24,770,43.63
11013 DATA 1140,64.82,1270,68.82,2450,124.94,1720,90.22,790,45.92,780,43.43
11014 DATA 950,50.87,1100,56.51,840,46.72,880,47.21,820,45.02,710,40.08
11015 DATA 1110,62.04,2520,134.39,1740,95.75,2080,115.95,1090,64.77,890,50.56
11016 DATA 900,50.97
11990 REM NATURAL GAS USAGE & MONTHLY COST
12000 DATA 0,0,0,0,0,0,0,0,95.2,16.85,57.7,-3.25
12001 DATA 41.5,5.50,14.2,4.30,78.0,14.29,18.2,5.07,96,17.49,205.8,34.62
12002 DATA 167.8,28.43,276.3,47.46,124.4,22.68,148.8,27.17,74.2,15.12,34.4,8.43
12003DATA 52.6,12.71,26.3,7.68,47.7,11.87,49.6,12.33,57.6,14.04,192.1,42.34
12004DATA136.4,32.22,221.2,51.14,188.9,44.42,141.4,34.56,71.8,19.45,36.6,10.77
```

More →

Listing continued.

```
12005 DATA 38.8,11.46,33.8,10.18,35.7,10.64,41.6,11.92,34.3,10.19,141.4,35.93
12006DATA219.2,55.82,216.4,51.75,137.6,35.79,110.3,27,72,19.20,40.6,11.28
12007 DATA 36.5,10.64,32.6,9.83,30.4,9.29,33.4,10.30,84.9,22.79,200.4,51.37
12008DATA 249.4,64.78,163.4,48.82,108.4,35.4,55,22.03,30.7,16.02,52.8,21.76
12009 DATA 29.6,16.07,26.4,15.24,32.5,17.49,61.7,25.69,154.8,51.43,205.4,64
12010DATA250,78.81,246.2,78.02,103.6,39.23,40.5,20.61,32.6,17.99,49.2,22.60
12011DATA27.6,16.57,42.7,20.91,30.5,17.47,56,24.88,123.6,44.57,154.1,53.37
12012DATA217,73.62,239.2,80.37,108.3,41.02,44.5,21.03,27.7,15.38,49.9,21.44
12013DATA29.1,15.01,43,19.11,35.2,18.39,63.9,28.49,120.3,48.11,156.5,60.26
12014DATA212.9,84,195.7,78.17,102.5,45.08,39.5,21.35,33.5,18.91,43.6,22.79
12015 DATA 29.3,16.94,39.6,21.25,35.6,20.39,55.8,28.38,142.1,63.08,0,0
13000 REM HEATING AND COOLING DEGREE DAYS
13010 DATA 935,0,854,0,511,0,365,15,191,29,1,263
13020 DATA 0,344,0,376,24,173,221,19,524,0,852,0
13030 DATA 830,0,869,0,613,4,309,24,148,57,14,126
13040 DATA 0,361,0,317,49,130,303,8,509,11,759,0
13050 DATA 818,0,720,0,702,0,436,4,66,112,2,252
13060 DATA 0,351,0,404,50,85,156,27,397,10,853,0
13070 DATA 1050,0,603,1,518,0,293,58,133,51,11,315
13080 DATA 0,317,0,284,34,114,377,9,716,0,1001,0
13090 DATA 1296,0,790,0,469,10,245,37,62,124,18,217
13100 DATA 0,439,0,401,9,329,278,7,476,10,904,0
13110 DATA 1101,0,1048,0,715,0,318,0,141,63,9,260
13120 DATA 0,344,0,413,33,182,280,12,483,00,763,0
13130 DATA 984,0,1100,0,520,15,354,4,75,72,6,193
13140 DATA 2,348,3,351,22,145,311,28,425,1,757,0
13150 DATA 1080,0,766,0,712,0,364,0,134,24,2,278
13160 DATA 0,363,0,293,24,208,96,36,571,20,652,0
```

D(M) = yearly average of month's electricity usage (KWH)
M(M) = yearly average of month's heating fuel (Therm)
T(M) = 30 year average monthly temperature
A = exterior area of house in square feet
P(M,Y) = heating degree days for a given month of a year
Q(M,Y) = cooling degree days for a given month of a year
E(M,Y) = electrical energy (KWH) for a given month of a year
F(M,Y) = cost of electricity in dollars for one month
G(M,Y) = heating fuel (gal. if heating oil, Therms if natural gas) for a given month of a year
H(M,Y) = cost of heating fuel for a given month of a year in dollars
Y0 = starting year
Y1 = ending year
E1 = air conditioner efficiency (assumed 50 percent)
E2 = furnace efficiency (assumed 50 percent)
U = number of BTU/(degree *hour* square foot)
R = 1/U = effective R-value of house
W = graph scale multiplication factor

Table 2. Variable identities.

Sample run.

```
*RUN

DO YOU HAVE ELECTRIC HEATING FOR YOUR HOME? (YES OR NO)?NO
DO YOU HAVE OIL HEATING FOR YOUR HOME? (YES OR NO)?NO


            YEARLY COST OF UTILITIES ($ DOLLARS )

YEAR        ELECTRICITY        NATURAL GAS        TOT. ENERGY    COST/DEG./DAY

1973        406.94999          94.869999          501.81999      .088084956
1974        591.59999          250.259999          841.85999      .154725233
1975        668.04999          282.87999          950.92999      .17464279
1976        670.91999          315.05999          985.97999      .167541205
1977        742.85999          398.72999          1141.58999      .186503838
1978        788.21999          435.02999          1223.24999      .19841849
1979        730.44999          442.22999          1172.67999      .205157451
1980        809.96999          420.33999          1230.30999      .218799572


U IS THE AVE. BTU/(DEG*HR*SQ.FT.). R = 1/U
T IS THE AVERAGE MONTHLY TEMPERATURE OVER 30 YEARS

            U                  R                  T
JAN   .128782699          7.7650181          32.699999
FEB   .167665786          5.964246          34.8
MAR   .142423688          7.0213038          43.3
APR   .174795641          5.7209664          53.899999
MAY   .269589761          3.7093396          63.199999
JUN   .243802851          4.1016747          72.199999
JLY   .194719424          5.1355944          76.699999
```

More

These values are useful if you are contemplating adding more insulation, or have just done so and wish to determine the cost-effectiveness of your work. The cost per degree per day shows the average of how much you can save each day by adjusting your thermostat one degree according to the season. The important point here is that the results reflect the way you actually live in your house.

How It Works

The program is written in a version of BASIC that can be easily adapted to a variety of systems. In the BASIC version used here, the RESTORE statement must precede any data statement to initialize the pointers. Most versions in use today do not require this first initialization, and therefore it can be deleted from those programs.

Some constants unique to your house are required in the program. In line 142 the exterior surface area, A, is needed. The ground floor or basement floor area is not included unless there is a crawl space under the house. This area includes all walls and ceilings which face the exterior of the house; i.e., the surface area through which the heat flows to the outside.

Lines 148 and 149 contain the beginning and ending years for which the data is available. For example, if the data was only for 1980, then Y1 and Y0 would be the same, because the data is recorded from January to December. Lines 150 through 180 contain the string data necessary for the graphics plots. The key variables are identified in Table 2.

Next, the data statements are read in the proper format. The program expects first to read the 30-year monthly average temperatures, T(M), in lines 218 to 240. This is an optional feature which can be dropped since it serves only as a guideline in the printout at lines 941, 943, 970 and 1030. It is not used in the calculations, but was included here because it was available from the U.S. Weather Service. The data statements starting at line 10010 will be different for different areas around the country.

Data from your electric utility bill is then entered in the data statements beginning with line 11000. Monthly kilowatt hours (KWH) and cost are entered as pairs, starting with January of the first year. If this data is

Communications Software from the Utility Specialists

What do you really need in good communications software? We think the most important thing is using the equipment YOU have to transfer data easily and accurately. When Ascii Express made its first appearance in 1979, it was immediately recognized as the finest program of its kind available. Since that time, other programs have appeared with one or two flashy new features, but not a single one of them offers as many choices in terms of hardware compatibility and data transfer modes as the SDS line of communications software.

ASCII EXPRESS II™
If a versatile and accurate data transfer program is what you're after, Ascii Express II is for you. It offers more data transfer modes than any other program of its kind. In fact, we have yet to find a computer system it can't be used with.

In addition, Ascii Express II offers a built-in editor that allows you to produce or modify files before and after transfer, a built-in directory for your most frequently called numbers, and keyboard macros which allow you to send entire sign-on sequences or other host commands with a few simple keystrokes. All these features are designed to help reduce on-line time, and that saves you money.

Z-TERM™
For CP/M users, Z-Term offers all the above, and more . . .

- Support of all 80-column boards and external terminals
- Large copy buffer (41K)
- Unlimited download capacity - no file is too large

For special applications, Z-Term will even allow your Apple to emulate most popular types of terminals for maximum compatibility with your system.

Z-TERM "THE PROFESSIONAL"™
The ultimate communications package. This is the finest program we offer, and it is certain to set the standard for all communications software for years to come.

Z-Term "Pro" provides the solid performance that the truly serious user demands. Many of our users find Z-Term "Pro" to be so valuable that it more than justifies the purchase of the Z-80 Softcard.

Z-Term Pro's special features include:

- Support of the new Novation Apple CAT modem
- Support of specialized transfer protocols, e.g. PAN and Christensen
- Automatic answer and send/receive modes for unattended operation
- Special buffer for parallel printers to ensure no lost characters

We are so convinced that all the SDS programs are the finest available that we've compiled a detailed point-by-point comparison of our programs and those of our leading competitors (for your copy, send a stamped, self-addressed envelope to us at the address below). This comparison of more than 50 items clearly shows what our customers have known all along - that SDS software is the finest. Amen.

CP/M is a trademark of Digital Research.
Z-80 Softcard is a trademark of Microsoft.

SDS
southwestern data systems ✓208
P.O. Box 582-K
Santee, CA 92071 Tel. 714-562-3670

not available, enter zeros for the KWH and cost for each missing month. Don't skip any months! The year is concluded with December's values.

The heating utilities (natural gas or heating oil) are entered in the same way starting with line 12000. The units for natural gas are therms and the units for heating oil are gallons. A therm is 100,000 BTU, and is the basic unit on most bills. The electricity and heating utility data must begin and end with the same year. The program will select the proper conversion constants depending on whether you use oil or natural gas for heating. This is determined by lines 300 to 450.

The program asks if you use electricity, gas or oil as the source for your home heating. If electric heat is used, then lines 382 through 484 are skipped, and the gas or oil data statements are not used. If oil heat is selected, the data statements beginning with line 12000 must show monthly gallons and cost expended. If neither electric nor oil heat is selected, the program defaults to natural gas as the heating fuel. The

Sample run continued.

```
AUG   .202107243           4.9478681           75.5
SEP   .36261267           2.7577635           68.699999
OCT   .223375197           4.4767727           57
NOV   .157076413           6.3663281           46.199999
DEC   .139170444           7.1854337           36.6

THE AVERAGES FOR 1973 TO 1980 ARE:
          U = .20051015
          R = 4.9872786
          T = 55.066666
AVE # HEATING DEGREE DAYS PER YEAR = 4526.875
AVE # COOLING DEGREE DAYS PER YEAR = 1234.75


DATA KEY:
         + = SINGLE DATA POINT
         * = MULTIPLE DATA POINT
         # = MONTHLY AVERAGE
         < = BELOW RANGE
         > = ABOVE RANGE



            ELECTRICITY USED PER MONTH

  ELECT. (KWH X 10)  75   100       150       200       250       300
      I----I----I----I----I----I----I----I----I----I----I----I----I----I
      I
JAN   I                   *#*+
      I
      I
      I
FEB   I                +#**
      I
      I
      I
MAR   I        +      #++*  +
      I
      I
      I
APR   I              *#+
      I
      I
      I
MAY   I           + +#* + +
      I
      I
      I
JUN   I                     *+ *#    + *
      I
      I
      I
JLY   I                        +         +      + #    *++    +
      I
      I
      I
AUG   I                                  +       *    #+   + +        *
      I
      I
      I
SEP   I                       +         +      #*+ ++          +
      I
      I
      I
OCT   I               +    +*#++           +
      I
      I
      I
NOV   I             + #+*
      I
      I
      I
DEC   I                *#*
      I
      I
      I----I----I----I----I----I----I----I----I----I----I----I----I----I

            NATURAL GAS USED PER MONTH

  GAS (THERMS X 1)  75   100       150       200       250       300
      I----I----I----I----I----I----I----I----I----I----I----I----I----I
      I
JAN   I                          +      +      # *+     *
      I
      I
      I
FEB   I                                +    +   +#   ++     +
      I
      I
      I
MAR   I                    ** #+  +         +
      I
      I
      I
APR   I       *+ +    #     +     + +
      I
      I
      I
MAY   I     **  #   *+   +
      I
```

More

computer case company

comp case

• RS204

• AP101	Apple II with Single Disk Drive	$109
• AP102	Apple II with Double Disk Drives	119
• AP103	Apple II, 9 inch Monitor & Double Drives	129
• AP104	Apple ///, two additional Drives & Silentype	139
• AP105	12 inch monitor plus accessories	99
• RS201	TRS-80 Model I, Expansion Unit & Drives	109
• RS202	TRS-80 Monitor or TV set	84
• RS204	TRS-80 Model III	129
• RS205	Radio Shack Color Computer	89
• AT301	Atari Computer & Accessories	109
• P401	Paper Tiger 440/445/460	99
• P402	Centronics 730/737 Line Printer II/IV	89
• P403	Epson MX70 or MX80	89
• P404	Epson MX100	99
• CC90	Matching Attaché Case	75

computer case company ✓320

5650 INDIAN MOUND CT. COLUMBUS, OHIO 43213 (614) 868-9464

THE COPYRIGHT KIT

How to Copyright Your Computer Software

A self-instruction booklet on copyrighting the computer programs you write. IF YOU EVER WROTE A COMPUTER PROGRAM YOU NEED THIS BOOK! INCLUDES: Step by Step instructions, sample forms, as well as discussions of copyrights, patents and trade secrets, your rights secured by copyright, legal remedies upon infringements, material not copyrightable and MUCH MORE! Written by Attorneys. Published by National Attorneys' Publications, Inc. and distributed exclusively through B.T. Enterprises.

ONLY $11.95

BT ENTERPRISES

B.T. Enterprises
171 Hawkins Road
Centereach, New York
(516) 981-8568 (Voice)
(516) 588-5836 (Data)
MNET-70331, 105

✓124 Add $2.00 S & H, NYS res. add appr. tax

Quality Products With Support And Service For Less!!!

16K Radio Shack Model 3 computer $839—48K for $899
With 2 40 track drives $1890 and a RS232 for $1959
16K for the Radio Shack Model 1, 3, and Apple 2+ $16

Percom Electric Crayon—add color and hi-res graphics to your model 1 $139

The Connection—for Model 1—300 baud—orig. only & direct connect for $119
Lex 11 coupler—300 baud—orig/ans-half/full duplex $129

Omnitek 40 track drive w/p.s. & case $295—80 track $395—5 & 3 ms access
Omnitek 80 track dual head drive with p.s. and case $499
Omnitek 8" disk drive power supply and case $699
Omnitek Power Supply and Case for 5" drives $63 and for 8" drives $139
Omnitek cables for 5" drives—2-drive for $24 and 4-drive for $29
Omnitek cables for 8" drives—1-drive for $24 and 2-drive for $34
Economy 5" double density disks $24 with center rings $28
Disks for 8" drive—double density $36

12" B&W Leedex (Amdek) Monitor $114 and 10" B&W APF Monitor $99

Base 2 printer $539 C.Itoh Starwriter $1439
Okidata Microline 80 printer $369 Tractor $50
Okidata Microline 82A printer $499 and 83A $749—120cps, uc/lc/graphics

commodore

Call for Quotes on Epson, Apple, and Commodore equipment.

Dealer inquiries invited. Mass. Residents add 5% Tax. F.O.B. Tewksbury, freight extra. M/C, Visa or check accepted.
TRS-80 is a reg. trademark of Tandy Corp.

✓140

Omnitek Computers International Inc., 1899 Main St., Tewksbury, Ma 01876

Sample run continued.

```
          I
    JUN   I     *+#*++
          I
          I
          I
    JLY   I    *#*  +
          I
          I
          I
    AUG   I  + *#*+*
          I
          I
          I
    SEP   I    **# +     +
          I
          I
          I
    OCT   I   +  ++#+*++
          I
          I
          I
    NOV   I      +    +   + +#   ++  +  +
          I
          I
          I
    DEC   I                          +  *   #  + +*
          I
          I
          I----I----I----I----I----I----I----I----I----I----I----I----I----I



               TOT. ENERGY USED PER MONTH

      ENERGY (KWH X 50) 75   100       150       200        250       300
          I----I----I----I----I----I----I----I----I----I----I----I----I----I
          I
    JAN   I                  +   +   #+*  ++
          I
          I
          I
    FEB   I                     +  +  #+ ++  +
          I
          I
          I
```

More

data statements must then contain the monthly therms and cost.

You must be sure when you enter the energy values from your utility bills that they correspond to the month the energy was used and not when the bill came due. This must be done to correlate energy consumption with the degree days for each month. Otherwise, there will be a skew in the graphs.

The final data needed is the heating and cooling degree days in each year for which utility bills are known. Starting with January, the heating and cooling degree days are entered as monthly pairs at line 13000. Enter heating then cooling for each month in the data statements (e.g., Jan. 1973: 935, 0).

M and Y are the month and year indices. The function in line 310 is used to reduce the year to a single digit for use in the FOR loop and in the two-dimensional arrays.

E1 and E2 in lines 954 and 955 are the efficiencies of the air conditioner and furnace. I assigned a reasonable approximation of 50 percent to each. If you have a more accurate value, use it. In lines 8910 and 8950 the

OSI TRS-80 COLOR-80 OSI

GALAXIAN - 4K - One of the fastest and finest arcade games ever written for the OSI, this one features rows of hard-hitting evasive dogfighting aliens thirsty for your blood. For those who loved (and tired of) Alien Invaders. Specify system — A bargain at $9.95 OSI

LABYRINTH - 8K - This has a display background similar to MINOS as the action takes place in a realistic maze seen from ground level. This is, however, a real time monster hunt as you track down and shoot mobile monsters on foot. Checking out and testing this one was the most fun I've had in years! — $13.95. OSI

THE AARDVARK JOURNAL

FOR OSI USERS — This is a bi-monthly tutorial journal running only articles about OSI systems. Every issue contains programs customized for OSI, tutorials on how to use and modify the system, and reviews of OSI related products. In the last two years we have run articles like these!

1) A tutorial on Machine Code for BASIC programmers.

2) Complete listings of two word processors for BASIC IN ROM machines.

3) Moving the Directory off track 12.

4) Listings for 20 game programs for the OSI.

5) How to write high speed BASIC — and lots more —

Vol. 1 (1980) 6 back issues - $9.00

Vol. 2 (1981) 4 back issues and subscription for 2 additional issues - $9.00.

ADVENTURES!!!

For OSI, TRS-80, and COLOR-80. These Adventures are written in BASIC, are full featured, fast action, full plotted adventures that take 30-50 hours to play. (Adventures are interactive fantasies. It's like reading a book except that you are the main character as you give the computer commands like "Look in the Coffin" and "Light the torch".)

Adventures require 8K on an OSI and 16K on COLOR-80 and TRS-80. They sell for $14.95 each.

ESCAPE FROM MARS (by Rodger Olsen)

This ADVENTURE takes place on the RED PLANT. You'll have to explore a Martian city and deal with possibly hostile aliens to survive this one. A good first adventure.

PYRAMID (by Rodger Olsen)

This is our most challenging ADVENTURE. It is a treasure hunt in a pyramid full of problems. Exciting and tough!

TREK ADVENTURE (by Bob Retelle)

This one takes place aboard a familiar starship. The crew has left for good reasons - but they forgot to take you, and now you are in deep trouble.

DEATH SHIP (by Rodger Olsen)

Our first and original ADVENTURE, this one takes place aboard a cruise ship - but it ain't the Love Boat.

VAMPIRE CASTLE (by Mike Bassman)

This is a contest between you and old Drac - and it's getting a little dark outside. $14.95 each.

OSI NEW-NEW-NEW OSI
TINY COMPILER

The easy way to speed in your programs. The tiny compiler lets you write and debug your program in Basic and then automatically compiles a Machine Code version that runs from 50-150 times faster. The tiny compiler generates relocatable, native, transportable machine code that can be run on any 6502 system.

It does have some limitations. It is memory hungry — 8K is the minimum sized system that can run the Compiler. It also handles only a limited subset of Basic — about 20 keywords including FOR, NEXT, IF THEN, GOSUB, GOTO, RETURN, END, STOP, USR(X), PEEK, POKE, -, =, *, /, , <, > , Variable names A-Z, and Integer Numbers from 0-64K.

TINY COMPILER is written in Basic. It can be modified and augmented by the user. It comes with a 20 page manual.

TINY COMPILER — $19.95 on tape or disk OSI

SUPERDISK II

This disk contains a new BEXEC* that boots up with a numbered directory and which allows creation, deletion and renaming of files without calling other programs. It also contains a slight modification to BASIC to allow 14 character file names.

The disk contains a disk manager that contains a disk packer, a hex/dec calculator and several other utilities.

It also has a full screen editor (in machine code on C2P/C4)) that makes corrections a snap. We'll also toss in renumbering and program search programs — and sell the whole thing for —

SUPERDISK II $29.95 (5¼") OSI

BARE BOARDS FOR OSI C1P

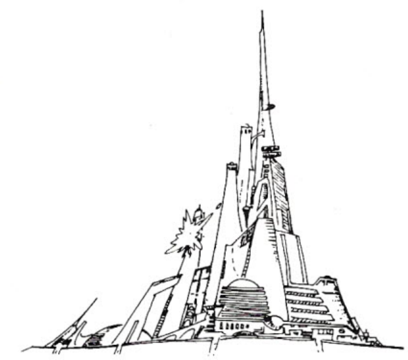
MEMORY BOARDS!!! — for the C1P — and they contain parallel ports!

Aardvarks new memory board supports 8K of 2114's and has provision for a PIA to give a parallel ports! It sells as a bare board for $29.95. When assembled, the board plugs into the expansion connector on the 600 board. Available now!

PROM BURNER FOR THE C1P — Burns single supply 2716's. Bare board — $24.95.

MOTHER BOARD — Expand your expansion connector from one to five connectors or use it to adapt our C1P boards to your C4/8P. - $14.95.

16K RAM BOARD FOR C1P — This one does not have a parallel port, but it does support 16K of 2114's. Bare Board $39.95.



WORD PROCESSING THE EASY WAY— WITH MAXI-PROS

This is a line-oriented word processor designed for the office that doesn't want to send every new girl out for training in how to type a letter.

It has automatic right and left margin justification and lets you vary the width and margins during printing. It has automatic pagination and automatic page numbering. It will print any text single, double or triple spaced and has text centering commands. It will make any number of multiple copies or chain files together to print an entire disk of data at one time.

MAXI-PROS has both global and line edit capability and the polled keyboard versions contain a corrected keyboard routine that make the OSI keyboard decode as a standard typewriter keyboard.

MAXI-PROS also has sophisticated file capabibilities. It can access a file for names and addresses, stop for inputs, and print form letters. It has file merging capabilities so that it can store and combine paragraphs and pages in any order.

Best of all, it is in BASIC (0S65D 51/4" or 8" disk) so that it can be easily adapted to any printer or printing job and so that it can be sold for a measly price.

MAXI-PROS — $39.95. Specify 5¼ or 8" disk.

SUPPORT ROMS FOR BASIC IN ROM MACHINES — C1S/C2S. This ROM adds line edit functions, software selectable scroll windows, bell support, choice of OSI or standard keyboard routines, two callable screen clears, and software support for 32-64 characters per line video. Has one character command to switch model 2 C1P from 24 to 48 character line. When installed in C2 or C4 (C2S) requires installation of additional chip. C1P requires only a jumper change. — $39.95

C1E/C2E similar to above but with extended machine code monitor. — $59.95 OSI

ARCADE GAMES FOR OSI, COLOR-80 AND TRS-80 (8K OSI, 16K TRS-80 AND COLOR-80)

TIMETREK - A REAL TIME, REAL GRAPHICS STARTRECK. See your torpedoes hit and watch your instruments work in real time. No more unrealistic scrolling displays! $14.95.

STARFIGHTER - This one man space war game pits you against spacecruisers, battlewagons, and one man fighters, you have the view from your cockpit window, a real time working instrument panel, and your wits. Another real time goody. $9.95

BATTLEFLEET - This grown up version of Battleship is the toughest thinking game available on OSI or 80 computers. There is no luck involved as you seek out the computers hidden fleet. A topographical toughie. $9.95

QUEST - A NEW IDEA IN ADVENTURE GAMES! Different from all the others, Quest is played on a computer generated mape of Alesia. Your job is to gather men and supplies by combat, bargaining, exploration of ruins and temples and outright banditry. When your force is strong enough, you attack the Citadel of Moorlock in a life or death battle to the finish. Playable in 2 to 5 hours, this one is different every time.
16K COLOR-80 OR TRS-80 ONLY. $14.95

Please specify system on all orders

This is only a partial listing of what we have to offer. We offer over 120 games, ROMS, and data sheets for OSI systems and many games and utilities for COLOR-80 and TRS-80. Send $1.00 for our catalog.

OSI

AARDVARK TECHNICAL SERVICES, LTD. ✓91
2352 S. Commerce, Walled Lake, MI 48088
(313) 669-3110

COLOR-80

scale factor W is specified for the five graphs. You may want to raise or lower these values, depending on the maximum utility value for any given month. The scale marking for each month is graduated from 0 to 325. W determines the multiplication factor that is used with this scale. In the sample run for the total energy used in the month of January, a data point occurs at the scale value of 100. The scale factor is 50 for this graph, so the data point represents total energy consumption of 5000 KWH.

Index I steps through the five graphs and determines the proper string variable lengths to be used in each plot. In line 9105 the values L and O are the respective minimum values for electricity and heating fuel. They are assumed to be the monthly operating conditions for the house without heating or cooling energy loads. L and O are arbitrarily set to a high value (i.e., 10,000). Lines 9107 and 9108 then choose the minimum nonzero values for L and O, respectively, from the data.

There is some question as to the merit of this assumption. The concept of the degree day is based on the fact that the inside temperature is assumed to be 70 degrees F, while degree days are determined based on 65 degrees F exterior temperature. Daily energy consumption, excluding heating or cooling, produces heat

Sample run continued.

```
MAR     I +            +#++ +     +
        I
        I
        I
APR     I  +    * +#    +   ++
        I
        I
        I
MAY     I     ** #  * +
        I
        I
        I
JUN     I         #* +
        I
        I
        I
JLY     I       + + +#*+*
        I
        I
        I
AUG     I           *#**
        I
        I
        I
SEP     I       +  +*# +    +
        I
        I
        I
OCT     I       +*#*
        I
        I
        I
NOV     I       + +  + # ++ ++
        I
        I
        I
DEC     I   +               + #   ++*
        I
        I
        I----I----I----I----I----I----I----I----I----I----I----I----I----I
```

More →

from appliances or lighting along with the solar energy absorbed.

If your version of BASIC cannot handle the double IF statements in line 8920, 8922, 9107 or 9108, then you can divide it into two or more lines each.

The graphs are constructed using the string variable D$, which is initially set to blanks for each line. Positions in the string are then assigned in lines 9150 through 9200 for the corresponding data points. This technique is often used with Teletype-based printers. This type of string handling lends itself nicely to this approach, but other string-handling systems can be modified to accomplish the same effect. See, for example, "Strings and Things: BASIC Conversion Techniques," by Richard Roth, *Kilobaud Microcomputing*, May 1978, pp. 94–98.

Conclusions

Although this is a rough cut at the energy efficiency of a house, it is remarkably accurate during peak heating and cooling months. There are a number of excellent pamphlets, bro-

Sample run continued.

```
                          DEGREE DAYS USED PER MONTH

HEAT+COOL(D.D.X 10)  75   100       150       200       250       300
      I----I----I----I----I----I----I----I----I----I----I----I----I----I
      I
JAN   I               ++ +#+*    +
      I
      I
      I
FEB   I           + ++#*    ++
      I
      I
      I
MAR   I         *#+ *
      I
      I
      I
APR   I     *#++
      I
      I
      I
MAY   I  #*
      I
      I
      I
JUN   I  +#*++
      I
      I
      I
JLY   I     +#  +
      I
      I
      I
AUG   I     *#*
      I
      I
      I
SEP   I  *#+ +
      I
      I
      I
OCT   I  ++#*++
      I
      I
      I
```

More

See List of Advertisers on page 210

Sample run continued.

```
NOV   I       ++# + +
      I
      I
      I
DEC   I            + *#*+ +
      I
      I
      I----I----I----I----I----I----I----I----I----I----I----I----I----I

            EGY/DEG.DAY USED PER MONTH

( BTU/DEG.DAY X 400)  75   100       150       200       250       300
      I----I----I----I----I----I----I----I----I----I----I----I----I----I
      I
JAN   I<       +#+*
      I
      I
      I
FEB   I<         *+#  * +
      I
      I
      I
MAR   I<     *  #*  *
      I
      I
      I
APR   I<   +*  + #    *     +
      I
      I
      I
MAY   I     + *+   #     ++*
      I
      I
      I
JUN   I       ++ ++#+++     +
      I
      I
      I
JLY   I     + *  #+ **
      I
      I
      I
AUG   I        +++# +  +
      I
      I
      I
SEP   I          +  +  + * #     + +       +
      I
      I
      I
OCT   I    +   +++# +         +
      I
      I
      I
NOV   I   +++  #  ++++
      I
      I
      I
DEC   I<      + #+*+
      I
      I
      I----I----I----I----I----I----I----I----I----I----I----I----I----I
```

chures and books for the layman on home insulation calculations (see references). Using one of these for the house illustrated in the sample run, an overall R-value of 7.4 was determined. As you can see, this agrees with the heating months' R-value as determined from the utility bills and degree day data.

The final graph is really a measure of the accuracy of the conductive model. It shows that the average energy consumed for every degree different from the interior temperature is relatively constant during the year. This is the chief reason why heating fuel suppliers use the degree day concept in their business.

If you're interested in acquiring a more detailed and accurate energy analysis for your house, there is an excellent booklet published by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402, for $1.35. It is called "Retrofitting Existing Housing for Energy Conservation: An Economic Analysis," by Stephen R. Petersen of the National Bureau of Standards. He sets up the variables and a flowchart for a BASIC program. Order S.D. Catalog No. C13.29:2/64.■

References

Money-Saving Guide to Energy in the Home by *Consumer Reports*. Doubleday and Co., Garden City, NY, 1978.

How to Do Your Own Home Insulation by L. Donald Meyers. Harper and Row, New York, 1978.

✓See List of Advertisers on page 210

Be the first one on your block to interface a Teletype to your Sorcerer. Whether or not you have a printer, you'll find the accompanying software useful.

Printing Wizardry For Your Sorcerer

By Ernest E. Bergmann

When I found that most printers cost almost as much as my Exidy Sorcerer, I bought an inexpensive old Teletype Model 33. The hardware, although not elegant, works (see schematic). And the software is useful even without a printer, letting you stop or slow the listing whenever you want.

The software for the interface had to meet several criteria.

First, it had to be a patch to my I/O drivers so that it would automatically be usable with BASIC or the development ROM Pac.

Second, it had to be small enough to fit in RAM below 100H.

Third, it needed to use the control code conventions of CP/M; control-P would turn on and off the printing and control-S would halt output. Another key would let the output resume.

Fourth, because the character set of the Model 33 printer is limited, all lowercase letters routed to the printer had to be converted to uppercase.

Finally, the program had to be clear and easy to modify for future needs, such as other printers and baud rates.

The I/O Patches

It is good programming to provide patch points for all of the I/O drivers, so that you can make changes without too much fuss.

You need to replace the original calls to the Sorcerer's keyboard with calls to your substitute routine, which behaves just like the original routine except that it filters out control-P for special action.

Also, you must replace the Sorcerer's original video routine with the new output routine. This new routine not only displays output on the video screen, but also drives the printer, and checks the keyboard for a control-S and takes the appropriate action when one occurs.

To substitute in our two I/O routines (CHIN and CHOUT) when using the Sorcerer's monitor, you can use the commands >SET I=50 and >SET O=5B. Or, to make life a bit easier, you can execute IOINIT (location 2AH in RAM, line 30 in the listing). This initialization routine calculates the locations in the monitor work area (MWA), where the addresses for CHIN and CHOUT must be placed, and then performs the two patches.

The Initialization Routine

IOINIT works properly with machine code programs that call the monitor's RECEVE input routine at E009H and the monitor's SEND output routine at 0E00CH. These requirements are innocuous enough for assembly-language user programs, and are met by the BASIC ROM PAC.

Also, a little detective work establishes that everything is all right in the Development ROM PAC; the I/O drivers, :SK and :SK, which are described on page 17 of the user's manual as the Sorcerer Keyboard and Sorcerer Video Screen, are actually using the monitor's RECEVE and SEND. You must beware of one potential problem: the Development PAC must be able to place a jump instruction at the RST 7 location, 38H, which is in the area where the IOINIT routine resides. After a little fitting with a relative jump instruction, you free up these critical three bytes.

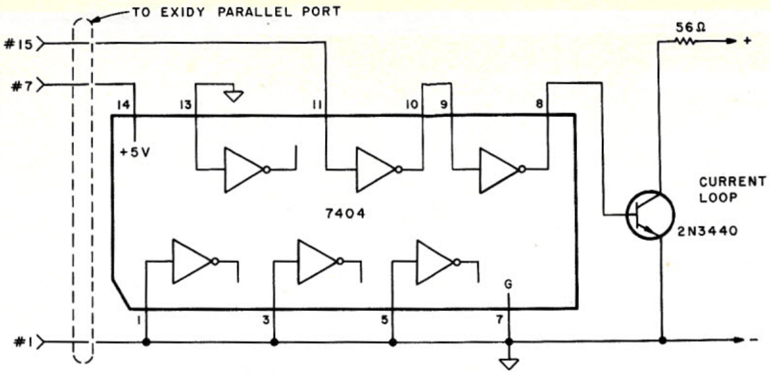
This is how you can find (and the way IOINIT finds) the proper location for the patches: the memory locations, 0F000H and 0F001H contain the value of the highest RAM address, which, of course, depends upon the particular computer configuration. By subtracting 6EH from (by adding 0FF92H to) this address you find the base address of the monitor work area (MWA). According to the Exidy documentation, MWA+3FH and MWA+40H should contain the address of the routine used by SEND, and MWA+41H and MWA+42H contain the address used by RECEVE.

Once the IOINIT routine performs its patches, it is no longer needed and can be overwritten to make use of all the RST locations.

The Input Routine

You require of the character input routine, CHIN, that if no key is pressed, it should return immediately with the Z flag set. If a key is pressed, the original KEYBRD routine waits until the key is released, and then returns with the ASCII value of the character in the A register

Address correspondence to Ernest E. Bergmann, Physics Department, Building 16, Lehigh University, Bethlehem, PA 18015.



Schematic of circuit used to convert the TTI_1 signals from one of the pins of the computer's output port to the active 60 mA (and 75 V) loop of the particular ASR33 unit the author has.

and the Z flag reset.

Similarly, CHIN would return when the key is released, except when a control-P has been entered. If this particular character has been typed, CHIN complements the variable STATE (used to control output to the printer) and CHIN reenters itself to get whatever follows the control-P. Thus, the calling program never is aware that a control-P was ever entered from the keyboard. The CHIN routine resides in lines 56–70.

The Output Routine

Let's turn our attention now to the character output routine, CHOUT. On entry (line 77 in the listing), CHOUT calls CTRLS, a routine which looks for a control-S from the keyboard (which will be described later).

Next (starting in line 78), CHOUT checks the value of STATE to see whether the printer should be sent any output. If STATE is zero, no action is taken and control is passed to the Sorcerer monitor's VIDEO at 0E01BH. Otherwise, CHOUT must send appropriate signals to the printer. The PRINT routine gets the character to the "primitive" typewriter output routine, PTYO, and then exits to the Sorcerer's VIDEO; PRINT ensures that the contents or registers are saved.

PTYO (starting at line 90) does most of the actual work, but it is not concerned with protecting the original contents of registers (that was PRINT's job). Since the Model 33 printer cannot produce symbols corresponding to ASCII codes higher than the character z, it doesn't try (it simply returns). The ASCII character 60H (\`), just before a, looks almost like a single quote or apostrophe, ASCII 27H ('); you make the printer print the substitute. Between 60H and z+1 you have the lowercase alphabet; since the printer has only uppercase type, you subtract 20H to convert it to uppercase.

You are almost ready to send the character to the printer, except that there are three control codes to which the printer should respond that require special handling. The line feed and carriage return characters take extra time to perform. The routines LF and CR provide extra time, which is adjusted by the value of WAIT; I picked a value which appears to work. It probably depends upon the lubrication in the printer mechanism, so you can change the value of WAIT easily.

A popular control code with the Exidy is control-L, the form feed character, which clears the screen. To keep things simple, I have implemented a reasonable facsimile with a carriage return followed by a number (FFSIZE) of line feeds.

After filtering out these three special control codes, we continue down to UART (line 112), which transmits the character to the printer.

The Software UART

To operate at 110 baud, I implemented a software UART. The hardware UART of the Sorcerer, which is already overused in the cassette and RS-232 interface, only operates at 300 and 1200 baud. The UART must send out a serial stream of binary data. At 110 baud, the time interval associated with each bit of data is 9.09 ms.

For current loop operation: when current is permitted to flow in the circuit, you call it the mark condition; when current cannot flow, you have a space condition. The mark and space conditions correspond to a binary 1 and 0, respectively. In asynchronous transmission, the pause or gap between characters should be mark.

When an individual character is sent, its contents are preceded by a start pulse (line 114), which consists of 9.09 ms of space. The next eight time intervals contain a mixture of marks and spaces, in accordance with

Program listing. Exidy assembly-language program to interface the Teletype Model 33.

```
EXIDY Z-80 ASSEMBLER
   ADDR  OBJECT      ST

                     0001
                     0002 ;
                     0003 ;***************************************
                     0004 ;*                                     *
                     0005 ;*       SIMPLE INTERFACE FOR ASR33    *
                     0006 ;*       by E.E. Bergmann              *
                     0007 ;*       JANUARY 4, 1981               *
                     0008 ;*                                     *
                     0009 ;***************************************
                     0010           PSECT   ABS
                     0011 ;
   >0005             0012 FFSIZE    EQU     5
   >00FE             0013 KEYPRT    EQU     0FEH
   >00FF             0014 PPORT     EQU     0FFH    ;EXIDY PARALLEL PORT
   >E018             0015 KEYBRD    EQU     0E018H
                     0016 ;
                     0017 ;
                     0018 ;*** OPTIONAL: *****************
                     0019 ;*                             *
                     0020 ;*       IOINIT IS OPTIONAL SINCE*
                     0021 ;* ONE CAN USE THE MONITOR     *
                     0022 ;* COMMAND, "SET I=,O=",ETC.   *
                     0023 ;*                             *
                     0024 ;* IT IS A CONVENIENCE IF ONE  *
                     0025 ;* DOES NOT USE THE RST AREA   *
                     0026 ;*                             *
                     0027 ;*******************************
                     0028           ORG     2AH
                     0029           GLOBAL  IOINIT
   002A  D5          0030 IOINIT    PUSH    DE
   002B  E5          0031           PUSH    HL
   002C  2A00F0      0032           LD      HL,(0F000H)
   002F  11D1FF      0033           LD      DE,0FF92H+3FH
```

More

the bit pattern of the byte that is being sent. This software UART sends two more intervals of mark (two stop pulses); the first stop pulse is the ninth and last pass through ULOOP, since, originally, the carry flag was set (line 116). The second stop pulse is created by jumping from ULOOP to MARK+2 (line 122).

The space and mark intervals are generated by the routines SPACE and MARK. They share a common timing loop, DELAY, where the time interval is controlled by the value of the variable PAUSE (introduced in line 88).

The CTRLS Routine

Lastly, I'll describe CTRLS (starting at line 170), which looks for and handles control-S; it is called from the beginning of CHOUT.

To find out if a control-S is pressed, it is not necessary to scan the whole keyboard, such as is performed by the monitor routine KEYBRD. A very limited scan is done by sending 3 to the keyboard port (KEYPRT) and inputting from that same port, testing only bit 2 (lines 171–174); if this bit is zero, the S key is pressed. The routine then looks to see if the CTRL key is also pressed (lines 178–181).

If these keys are not both pressed, then CTRLS returns without doing anything. However, if the control-S combination is pressed, you end up at YES (line 185). YES will scan the keyboard repeatedly until the keys are released before we get to K2 (line 187). K2 waits until another character is typed; while it is waiting, the listing has stopped and you can examine the display at your leisure. The listing resumes when you type that second character that K2 expects. Because K2 uses CHIN (line 187), you can turn the printer on or off with a control-P.

Conclusion

This package has given me great pleasure. It is useful even without the printer because the listing can be stopped or slowed whenever you want. With the printer you may abstract, letting the listing fly by until the portion of interest is reached. Pressing control-S stops the display; pressing control-P readies the printer; and pressing any key restarts/resumes the listing, this time with the printer engaged. When the printout becomes uninteresting, use control-S, control-P and any key to stop the listing, disengage the printer and resume high-speed CRT display.■

Listing continued.

```
0032  19      0034         ADD    HL,DE
0033  115B00  0035         LD     DE,CHOUT
0036  1803    0036         JR     RST7+3-$
              0037 ;
              0038         ORG    38H      ;RST 7 LOCATION
0038  C3A3C0  0039 RST7    JP     0C0A3H   ;USED BY DDT
              0040 ;
003B  73      0041         LD     (HL),E
003C  23      0042         INC    HL
003D  72      0043         LD     (HL),D
003E  23      0044         INC    HL
003F  115000  0045         LD     DE,CHIN
0042  73      0046         LD     (HL),E
0043  23      0047         INC    HL
0044  72      0048         LD     (HL),D
0045  E1      0049         POP    HL
0046  D1      0050         POP    DE
0047  C9      0051         RET
              0052 ;*** END OF (OPTIONAL) IOINIT ***
              0053 ;*******************************
              0054 ;
              0055 ;
              0056 ;*** CHARACTER INPUT ROUTINE: ***
              0057 ;
              0058         GLOBAL CHIN
              0059 ;
0048  3A6900  0060 YEP     LD     A,(STATE)         ;FLIP STATE
004B  2F      0061         CPL
004C  326900  0062         LD     (STATE),A
004F  F1      0063         POP    AF
0050  CD18E0  0064 CHIN    CALL   KEYBRD
0053  C8      0065         RET    Z        ;NO CHAR YET
0054  F5      0066         PUSH   AF
0055  FE10    0067         CP     10H      ;CTRL-P?
0057  28EF    0068         JR     Z,YEP-$
0059  F1      0069         POP    AF
005A  C9      0070         RET
              0071 ;
              0072 ;
              0073 ;*** CHARACTER OUTPUT ROUTINE: **
              0074 ;
              0075         GLOBAL CHOUT
              0076 ;
005B  CDDB00  0077 CHOUT   CALL   CTRLS
005E  F5      0078         PUSH   AF
005F  3A6900  0079         LD     A,(STATE)
0062  A7      0080         AND    A
0063  2009    0081         JR     NZ,PRINT-$
0065  F1      0082 TOVID   POP    AF       ;TO VIDEO IN
0066  C31BE0  0083         JP     0E01BH   ;MONITOR
              0084 ;
              0085 ;*** SYSTEM VARIABLES: *********
              0086 ;
0069  00      0087 STATE   DEFB   0        ;0=NO PRINT
006A  B004    0088 PAUSE   DEFW   04B0H    ;110 BAUD
006C  401F    0089 WAIT    DEFW   8000     ;CR _LF
              0090 ;
006E  F1      0091 PRINT   POP    AF
006F  F5      0092         PUSH   AF
0070  E5      0093         PUSH   HL
0071  CD7900  0094         CALL   PTYO
0074  E1      0095         POP    HL
0075  18EE    0096         JR     TOVID-$
              0097 ;
0077  3E27    0098 APOSTR  LD     A,27H    ;APOSTROPHE
0079  FE7B    0099 PTYO    CP     'z'+1    ;REGS DESTROYED
007B  D0      0100         RET    NC
007C  FE60    0101         CP     60H
007E  28F7    0102         JR     Z,APOSTR-$
0080  3802    0103         JR     C,NOTLC-$
0082  D620    0104         SUB    20H      ;LC -> UC
0084  FE0A    0105 NOTLC   CP     0AH
0086  2835    0106         JR     Z,LF-$
0088  FE0D    0107         CP     0DH
008A  283D    0108         JR     Z,CR-$
008C  FE0C    0109         CP     0CH      ;"CLEAR SCREEN"
008E  283E    0110         JR     Z,FF-$
              0111 ;
0090  F5      0112 UART    PUSH   AF
0091  E5      0113         PUSH   HL
0092  CDA400  0114         CALL   SPACE
0095  2E09    0115         LD     L,9
0097  37      0116         SCF
0098  1F      0117 ULOOP   RRA
0099  DCA900  0118         CALL   C,MARK
009C  D4A400  0119         CALL   NC,SPACE
009F  2D      0120         DEC    L
00A0  20F6    0121         JR     NZ,ULOOP-$
```

More

Listing continued.

```
00A2  1807                JR     MARK+2-$
                  ;
00A4  F5          SPACE   PUSH   AF         ;'ZERO'
00A5  AF                  XOR    A
00A6  D3FF                OUT    (PPORT),A
00A8  F1                  POP    AF
00A9  F5          MARK    PUSH   AF         ;'ONE'
00AA  E5                  PUSH   HL
00AB  2A6A00              LD     HL,(PAUSE)
00AE  23          DELAY   INC    HL
00AF  24                  INC    H
00B0  2D          DLOOP   DEC    L
00B1  20FD                JR     NZ,DLOOP-$
00B3  25                  DEC    H
00B4  20FA                JR     NZ,DLOOP-$
00B6  3EFF                LD     A,0FFH
00B8  D3FF                OUT    (PPORT),A
00BA  E1                  POP    HL
00BB  F1                  POP    AF
00BC  C9                  RET
                  ;
00BD  F5          LF      PUSH   AF         ;LINEFEED
00BE  3E0A                LD     A,0AH
00C0  CD9000      UARTW   CALL   UART       ;UART+DELAY
00C3  E5                  PUSH   HL
00C4  2A6C00              LD     HL,(WAIT)
00C7  18E5                JR     DELAY-$
00C9  F5          CR      PUSH   AF         ;CARRIAGE
00CA  3E0D                LD     A,0DH      ;RETURN
00CC  18F2                JR     UARTW-$
                  ;
                                            ;FORMFEED
00CE  CDC900      FF      CALL   CR         ;LEAVES FFSIZE OF
00D1  C5                  PUSH   BC         ;BLANK LINES ON PRINT
00D2  0605                LD     B,FFSIZE
00D4  CDBD00      FFLOOP  CALL   LF
00D7  10FB                DJNZ   FFLOOP-$
00D9  C1                  POP    BC
00DA  C9                  RET
                  ;
                  ;***** CTRLS: ******************
                  ;*                              *
                  ;*      CHECKS TO SEE IF CTRL-S *
                  ;* IS PRESSED.  IF SO, IT WAITS *
                  ;* UNTIL A SECOND KEY IS PRESSED*
                  ;*                              *
                  ;********************************
                  ;
00DB  F5          CTRLS   PUSH   AF
00DC  3E03                LD     A,3
00DE  D3FE                OUT    (KEYPRT),A
00E0  DBFE                IN     A,(KEYPRT)
00E2  E604                AND    4
00E4  2802                JR     Z,CTRLQ-$
00E6  F1                  POP    AF
00E7  C9                  RET
00E8  3E00        CTRLQ   LD     A,0        ;CTRL PRESSED?
00EA  D3FE                OUT    (KEYPRT),A
00EC  DBFE                IN     A,(KEYPRT)
00EE  E604                AND    4
00F0  2802                JR     Z,YES-$
00F2  F1                  POP    AF
00F3  C9                  RET
00F4  CD18E0      YES     CALL   KEYBRD     ;BOTH KEYS PRESSED
00F7  28FB                JR     Z,YES-$
00F9  CD5000      K2      CALL   CHIN       ;ENABLE OPERATOR TO
00FC  28FB                JR     Z,K2-$     ;CHANGE PRINT STATE
00FE  F1                  POP    AF
00FF  C9                  RET
                  ;
                  ;************************
                  ;*  END SHOULD NOT      *
                  ;*      OVERWRITE 100H  *
                  ;************************
                  ;
ERRORS=0000
APOSTR      0077 CHIN    [INT] 0050 CHOUT   [INT] 005B
CR          00C9 CTRLQ         00E8 CTRLS         00DB
DELAY       00AE DLOOP         00B0 FF            00CE
FFLOOP      00D4 FFSIZE        0005 IOINIT  [INT] 002A
K2          00F9 KEYBRD        E018 KEYPRT        00FE
LF          00BD MARK          00A9 NOTLC         0084
PAUSE       006A PPORT         00FF PRINT         006E
PTYO        0079 RST7          0038 SPACE         00A4
STATE       0069 TOVID         0065 UART          0090
UARTW       00C0 ULOOP         0098 WAIT          006C
YEP         0048 YES           00F4
```

Call For Manuscripts

Kilobaud Microcomputing is looking for business articles!

Businessmen in all fields are beginning to take notice of the microcomputer. They are eager to know which computers, peripheral equipment and applications software will let them take full advantage of this new tool. What knowledge do you have to share?

Here are the kinds of articles that we want you to write for us:

- Are you a businessman with a system up and running? We want to know how it works. What were your expectations? Have they been fulfilled? Did you find the software that you wanted? What problems have you had? How did you overcome them? What recommendations do you have for other businessmen?
- We want reviews from a businessman's perspective of specific hardware and software. If you've recently bought a new product and want to tell others how great—or poor—it is, *Microcomputing* will provide you with a forum.
- What programs have you written to meet your specific needs? Perhaps another businessman can use them, too. Even if he can't, your program may serve as a springboard for other ideas.
- Perhaps you aren't using your micro for business, but know a company that is. Trot on down with your pencil and notebook, and find out what they're up to. While they might not have the time to write up their experiences, they might be more than willing to tell somebody else about them. And an outside observer will often be able to see things with a unique and valuable perspective.

Don't worry if you're not a professional writer. That's what we editors are here for. And we'll be more than happy to send you a copy of our writer's guidelines.

Send your manuscripts and correspondence to:
Kilobaud Microcomputing
Pine St.
Peterborough, NH 03458

You do, if you use your Apple for telecommunications purposes.

Data Capture: Who Needs It?

By David Goodfellow

Data Capture 4.0, by Southeastern Software, is advertised as "the most advanced and easiest to use telecommunications program for use with the Micromodem II or the Apple Communications card." After using the program for several weeks, I have no reason to doubt it.

Of course, it isn't necessary. When I want my Apple to talk with another computer, I can always access my modem directly by typing in the appropriate commands. I can read fast when the other computer is sending, or connect directly to my printer. I can give the other guy sloppy input by typing directly to him. And I can let my Source charges pile up while I read my mail or try to send some. No, Data Capture 4.0 isn't necessary at all.

But boy, does it make things easy. Data Capture 4.0 requires a 48K Apple II with at least one disk drive using 3.2, 3.2.1 or 3.3 DOS. With it you can:

- Prepare messages off-line and squirt them through the phone at 110 or 300 baud—a lot faster than I can type.
- Take down all incoming data at either baud rate to read later at your convenience—no more eyestrain as the information scrolls off the top of the screen.
- Save that data to disk for later use—either to print or view on the monitor, at your own reading speed.
- Upload or download Applesoft or Integer programs as text files—which are easily converted back to their original program state with EXEC.
- Use a number of "special characters" which are not normally accessible to the Apple II—underline, left square bracket, back slash, vertical bar, left and right curly brackets.

Data Capture is sold as a single disk, with 24 solid 8-1/2 × 11-inch pages of documentation. The manual (and the program itself) practically begs you to make backup copies, and gives step-by-step instructions on how to do this. It then tells you how to configure one of your backups to your system, and how to copy your *configured* backup. If you follow all of the instructions, you'll wind up with four disks—two unconfigured, and two configured. Unless you stack them all together and drive a stake through their hearts, you should never be without a usable copy.

Booting a configured Data Capture disk brings up a blank screen with four status lines at the top. More about these later. Press escape and the master menu is displayed, inviting you to select one of the following features:

List Text—This displays whatever you have in the capture buffer—whether you typed it yourself, accessed it from a text file or received it via telecommunications. The buffer is line-oriented (up to 500 lines), and you can start your list from any line, stop the listing to view the screen and then continue, or exit the listing feature at any time.

Delete Text—This allows you to delete any part (or all) of the material in the capture buffer. It's used for editing, and for clearing the buffer.

Insert Text—This lets you insert up to ten lines of text at a time anywhere within the text in the buffer. If ten lines isn't enough, you can do it again—and again. The program asks the line number you wish the insert to precede, and displays that line for reference while you enter the new text. This function, with Delete Text, provides sufficient editing capabilities to massage the text any way you wish. It's not as fancy as most word processing programs, but it does the job.

Send Text—Send Text is used when you're on line with another system. Escape to the menu and hit S. The program asks you a starting and ending line number to send; when you give it these numbers, the text is on its way. Or press A for all, and all the text in the buffer goes.

Print Text—Print Text sends the contents of the buffer to the printer, with the same choices as mentioned in Send Text.

Write to File—This feature writes the entire contents of the buffer to a text file on disk, under any name you choose. If you choose a name that already exists on the disk, it will tell you so and ask if you wish to overwrite it. If not, you can escape and try again, using another file name.

Note that this feature is automatic if you have allowed the buffer to fill up. In this case, the program writes the contents to disk under the name "Overflow" "-1," "-2," etc. If you already had an "Overflow-1" on the disk from a previous session, you've lost it. This would be considered a pilot error—not the program's fault.

Merge from File—This reads the contents of any text file you name from disk to buffer.

Catalog Disk—I most often use this with Merge from File—mainly be-

Address correspondence to David C. Goodfellow, PO Box 66834, Seattle, WA 98166.

cause I can never remember the name I used to write to file.

Enter Phone Number—This is used with the Micromodem only. The program asks you to type in the phone number desired, and after giving you a chance to verify it, calls the number. If you are using The Source and have configured Data Capture 4.0 to use the function, you may type S for the phone number and the program will call in and log on for you.

Hang Up Phone—Micromodem only. Hangs up phone.

Await Call—Micromodem only. This lets you set up the computer for remote access. The computer expects another computer. "If a man answers, hang up."

Quit Program—Soft exit. You can quit the program through this selection without losing anything in memory. This allows you to catalog the disk and delete, rename or otherwise fiddle with your files. GOTO 1000, and you're back in business. Or, you can quit for good.

Toggle—This feature presents a separate menu of two-state functions which can be switched back and forth. These functions are:

- Alternate Drive (1 or 2). With this you can write, read or catalog on either drive. Default value is 1. I like to use drive 2 for text files, so I don't fill up the disk the program is on. Of course, the whole program is in memory, so single-drive users can simply replace the program disk with an initialized data disk.
- Baud Rate (110/300). Set as required.
- Capture (on/off). Extremely valuable. With this you can avoid capturing information you know you won't want to keep—such as introductory lines of bulletin board systems, etc.; then you can turn the function on when you're ready to receive the information you're after.
- Duplex (full/half). Use half duplex when off-line, and full when communicating with those systems that need it.
- Local Carrier (on/off). Micromodem only. This is useful when two Apple owners wish to suspend computer communications and talk by voice.
- Special Characters (on/off). This function, when on, lets the Apple use certain characters which are not normally available to it. For instance, I used the underline a few days ago to delete a file in The Source that was put in by an ex-user of my account. The file was sitting in there running up the bill, with the underline character part of the file name. The Source customer service could have taken it out for me, but it's much more satisfying (and certain) when you do it yourself.
- Transmit (on/off). You can use this function while on-line to type something into your buffer without sending it to the other station.

When not in the master menu, the screen is clear except for the contents of the capture buffer and the status lines at the top of the screen. These lines show the state of the toggle functions, plus one other indicator, Lines. This function does not toggle. It merely tells you how many lines of text you have in your buffer. When it nears 500, you know you had better transfer it to disk—or the program will do it for you. This is useful when you wish to download a program which you know will take most of the buffer. It helps you make the judgment.

Note that every function on the menu is available to you even while you are on line. When you press escape to go to the menu, Data Capture sends a stop code (CTRL-S) recognized by most remote services, so that incoming data is not lost while you choose a function. Resume operation with whatever code the other system recognizes—usually any key, return or CTRL-Q.

Let's say you're carrying on a correspondence with Source (or other timeshare system) users. Your last bill almost did in the family Lord Exchequer and you have to cut the costs or sell Aunt Minnie's diamonds to stay solvent. Since Aunt Minnie's bigger than you are, the latter solution is dangerous.

Enter Data Capture 4.0.

You place into your disk drive a disk which you have configured according to explicit instructions in the documentation, and "PR#6" it. When the program comes up, you press escape for the menu, E for enter, and S for Source. The program displays your local Telenet or Tymnet phone number and asks if it's correct (it always is, if you entered it right the first time). You press Y for yes, and Data Capture takes if from there, dialing in and logging on for you.

When The Source comes on you go directly to MAIL, READ, and sip your coffee or something else while your mail is being dumped at 110 or 300 baud. You don't take notes. You don't risk eyestrain or mental fatigue trying to keep up with your mail while it scrolls off the screen. When all your mail is in, you type quit, then off. The Source logs you off, after which you hit escape and select H (hang up) from the menu.

You dump the mail to your printer
or to disk for later viewing.
If you don't have a printer,
you can reread the mail through the display
as often as you wish.

Then, on your own time (the meter's not running anymore), you dump the mail to your printer or to disk for later viewing. If you don't have a printer, you can reread the mail through the display as often as you wish.

Still off-line, you answer each piece of mail by typing it into Data Capture, using the program's delete and insert features to edit what you've done. When all your mail is answered, you jump back into The Source and send it—faster and more accurately than you could have typed it on-line.

The two Source sessions together cost a lot less than if you had done it manually in one session. Aunt Minnie's diamonds are safe!

Just for fun the other night I took (downloaded) an Apple program from a public access file belonging to another user of The Source. The other user had left it as a text file for that purpose. Data Capture took it easily, and on command dumped it to disk. I then exited Data Capture and went to Integer—still in DOS.

With the command EXEC RANDOM SENTENCES, I brought it into memory as the Integer program it was, then rewrote it to disk with

SAVE RNDM SENTENCES. Not needing the text file any more, I typed DELETE RANDOM SENTENCES. That's all there was to it! RNDM SENTENCES is available to me whenever I want it, and it runs beautifully.

You can send Applesoft or Integer programs just as easily, by converting them to text files with the program called (appropriately) CREATE.TXT, and included on the disk. The only requirement for any data to be uploaded or downloaded is that it be formatted as a text file.

Occasionally, I like to advertise a certain product or service in bulletin board systems across the country. I look forward to trying it with this program, because last time I did it (manually) the long distance charges just about cancelled the profits—and my ads didn't look that great because it's hard for me to type and proof copy with the knowledge that Ma Bell's meter is ticking.

With Data Capture 4.0, I'll prepare the ad off-line, and when it's done to my satisfaction, I'll go down the list of bulletin boards, call each in turn, squirt my message at it, and hang up—hit and run. Each call will be under three minutes, and I'm betting that my phone bill will be considerably less than when I did it manually.

No, Data Capture 4.0 isn't necessary. But if you're into telecommunications, it takes away most of the drudgery and shuts off the meter a lot quicker. Isn't that what computers are all about—automating the drudgery jobs and cutting costs?

There are some things I'd like changed. For instance, timeshare systems like The Source operate full-duplex. This means that the system echoes back to your Apple everything you send, character-by-character (invisibly, of course). The program handles this all right, except for line feeds. Every time you press return you get two—one from your keyboard and one from the echo. This can fill the buffer pretty fast.

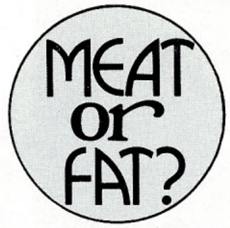
I'd like to see the program made compatible with some of the other modems hitting the market. Many bulletin boards support 600 baud and faster. When you're operating long distance, faster is cheaper.

I suppose that the send routine could be speeded up a little if it didn't have to wait for the echo of each character sent. But speeding it up in this way may not be a good idea. I think I prefer the confirming echo.

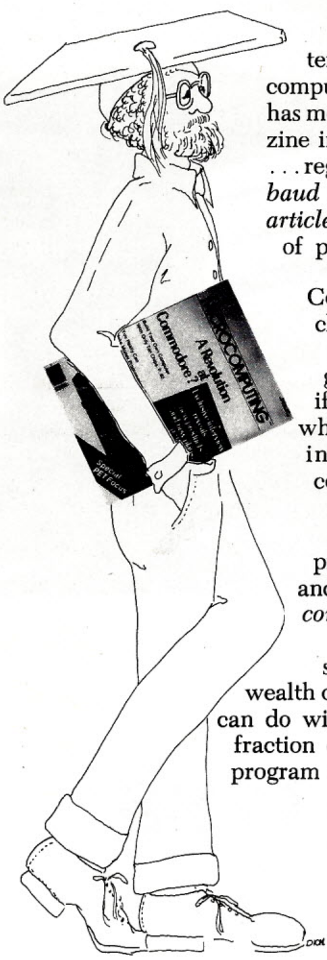
Every day it becomes harder to find major faults with Apple software that is being sold successfully. A couple of years ago users were happy with a program which could play a reasonable game of tic-tac-toe without crashing every third game. Now, programs are more sophisticated and distributors more critical. The result is software that is user-oriented, relatively crash-proof, and very, very useful or entertaining. Programs that aren't just don't make it. This one made it.

Data Capture 4.0 is probably available at your local computer store, listing for $65. If you can't find it there, try Southeastern Software, 6414 Derbyshire Drive, New Orleans, LA 70126. Owners of the previous version, Data Capture 3.0, can upgrade by sending in their old disk and documentation, plus $37.50. The program is written in Applesoft and machine language, and supports the Paymar lowercase adapter.■

Are you looking for . . .



When you subscribe to a magazine, you want to get REAL SOLID INFORMATION, not just a giant catalog of ads every month . . . and mostly the same ads, if you've noticed. *Kilobaud Microcomputing has the meat:* feature articles written by the most knowledgeable people in the field, yet written for the relative newcomer to computing. *Kilobaud Microcomputing* has more articles than any other magazine in the field . . . by a wide margin . . . regardless of fatness. In 1980 *Kilobaud Microcomputing* published *409 articles* . . . and that included a wealth of programs which you could use.

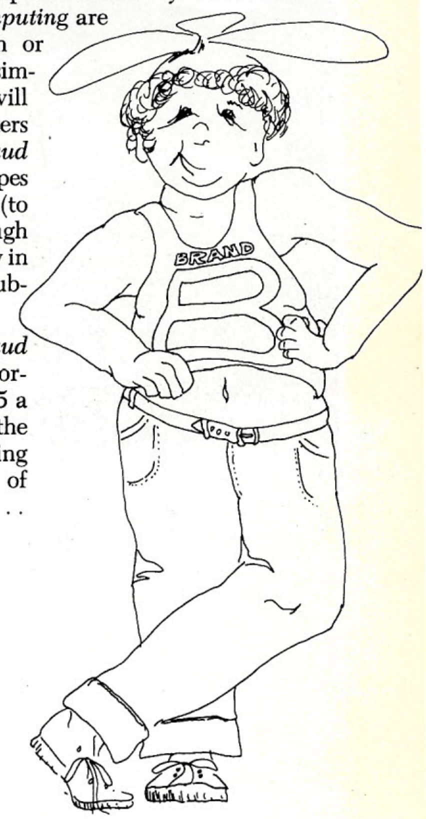


Compare that with 133 paltry articles in *Brand B*, the "*Fat Albert*" of the computer field. You can get far more from your computer if you can really understand it, which is where the simple articles in *Kilobaud Microcomputing* come in. You don't need a science degree to get through it like some magazines I could mention. The practical reviews of both hardware and software in *Kilobaud Microcomputing* can save you a bundle . . . far more than the cost of a subscription . . . even for life. The wealth of programs give you things you can do with your computer . . . again at a fraction of the cost of buying the same program over the counter. Further, the articles on programs *help you learn* how to write and modify programs that you have to do yourself.

When you subscribe to a magazine, you want to pay for the information, not a bunch of ads. The advertisers are already paying for them so why should you? *Kilobaud Microcomputing* has been running around 40% advertising while *Brand B* has been running 60-70%, making fat issues, but with *little real information* for you.

You want to learn about computers as fast as you can. The editors of *Kilobaud Microcomputing* are under orders (pain of death or worse) to keep the material as simple as possible so new comers will be able to learn about computers as quickly as possible. *Kilobaud Microcomputing* covers all types of microcomputers, including (to some extent) the TRS-80 though this is covered overwhelmingly in *80 Microcomputing*, a sister publication.

At $2.95 a copy, *Kilobaud Microcomputing* is the best information buy you'll find. At $25 a year (you save $10.40 off the newsstand price) you're investing in the most valuable library of microcomputing you can buy . . . 2,960 pages in 1980!



☐ **So, please bill me $25 for one year's subscription to *Kilobaud Microcomputing.***

Canadian $27/1 year only, US funds.
Foreign $35/1 year only, US funds.
Please allow 4-6 weeks for delivery.

name ____________________

street ____________________

city ____________ **state**________ **zip**_____

Kilobaud Microcomputing ● Box 997 ● Farmingdale NY 11737

is a division of GREEN **Peterborough NH 03458**

31DB7

See List of Advertisers on page 210

Business Is Our Business

Gene Cayot, Sales Manager, MSI. . .

We have been building commercial quality computer systems for 11 years now. . . a lot longer than most companies in our industry. Our reputation for quality and reliability has been firmly established in over twenty different countries where MSI Business Systems are sold.

Let me tell you more about MSI and our business systems. . .

With MSI you get a lot

more than just hardware.

Technical Support

We offer the finest and most extensive customer support of any company in our industry. Our systems are equipped with modems which permit our technical support staff to perform system diagnostics and file maintenance remotely via telephone lines. Our company aircraft allows support personnel to be at the customer's site within a few hours if necessary.

Expandability

Our systems do not have built-in obsolescence. Any MSI computer system can be expanded to run in multi-user mode, with large capacity hard disk drives, and with our business software. MSI systems can grow, as your business grows, to meet your needs.

Customer Training

We hold seminars at selected locations around the country which provide training in all areas of MSI system operations — from installation to the use of our business software.

Business Is Our Business

Our business software modules are designed for "real world" business use. We offer complete audit trail files for all changes to the data base, complete history files, and general ledger posting files. Back-up routines provide maximum protection of the data files on removable disk cartridges.

Let MSI help your business run better

If you have a problem in inventory control, bills of material, order entry/accounts receivable, general ledger, or cost accounting — give me a call personally for more information on an MSI Business System.

IBM's entry into the microcomputing fray with its 16-bit Personal Computer will give the industry a big boost.

IBM Thinks Small

By G. Michael Vose

Hundreds of thousands of Americans have seen an IBM computer in their local bank or at the office where they work. IBM means computers to many people. Therefore, a Personal Computer with the name IBM on it will sell a million, right?

Perhaps not. The new IBM Personal Computer will be a solid investment for anyone who needs a computer, but it is, above all, a computer. Not everyone needs or wants a computer—some people are even anti-computer. But it would seem, based upon a look at the Personal Computer, that IBM has, at least, done everything right while making its first truly personal computer.

The IBM Personal Computer with video display, two disk drives and 80-column printer.

The Right Combination

The executives at IBM apparently used this formula in developing the Personal Computer: Make it expandable for the future. Make it compatible with existing software. Make it attractive. And make it easy to use.

It is hard to imagine how you could go wrong with this formula, and it would be a safe bet that IBM will succeed in selling many Personal Computers in the years ahead: not simply because of the name IBM, but because the company has obviously learned a great deal from other manufacturers' mistakes.

The instruction manuals are the first clue. IBM has used its vast corporate resources and a well-trained staff of technical writers to prepare the most thorough, easy-to-understand instruction manuals I've ever seen. I would even hesitate to call these manuals documentation, because they are so well written they don't seem to fit into that category; typically, documentation is stilted in style and full of awkward conventions.

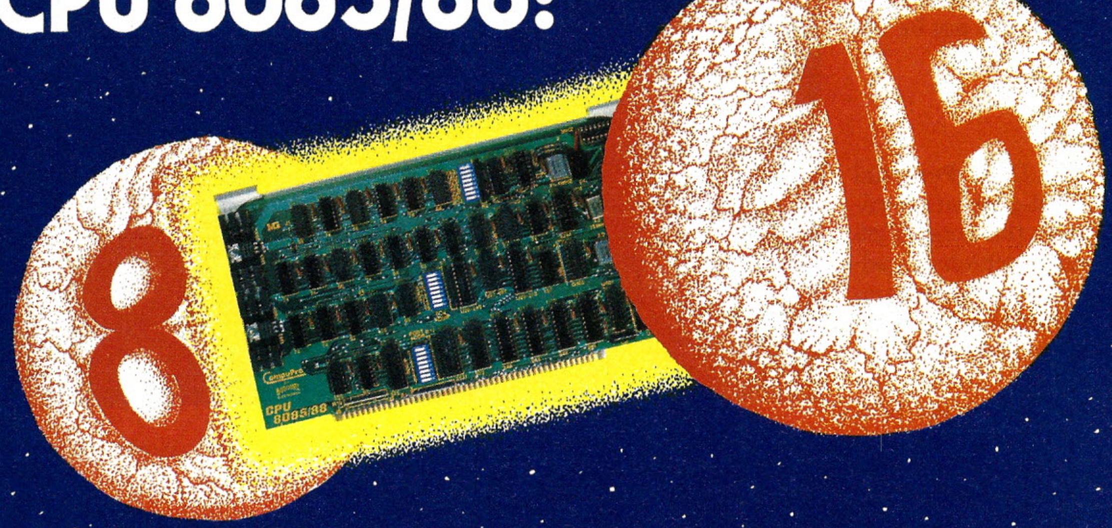
The Personal Computer comes with four manuals (if configured for disk operation), a BASIC language manual, a disk-operating system manual, a manual on setting up the computer, and a separate manual describing all the additional peripherals and the software you can buy. A fifth manual will become available soon, for an extra $150, containing the technical and repair information for the system.

These manuals are remarkably free of jargon, at least until you are ready for some, and are bound in hardcover 6 by 9 inch three-ring binders.

The Personal Computer looks good. The keyboard, system unit and video display are housed in separate boxes attached to one another by cables. This modular design gives the

G. Michael Vose is a technical editor for Microcomputing *magazine.*

CPU 8085/88:



MORE THAN A BRIDGE BETWEEN TWO WORLDS

When we shipped the first **CPU 8085/88** back in June of 1980, we created more than a bridge between the 8 bit world of the present and the 16 bit world of the future: We created a standard for professional level, high speed 8/16 bit computing on the S-100 bus. Already a standard in the software industry, **CPU 8085/88**'s unique combination of an 8088 to handle 16 bit software - along with an 8085 to execute 8 bit software - has withstood the test of time and is now recognized as the most efficient way to introduce 16 bit power into an 8 bit system.

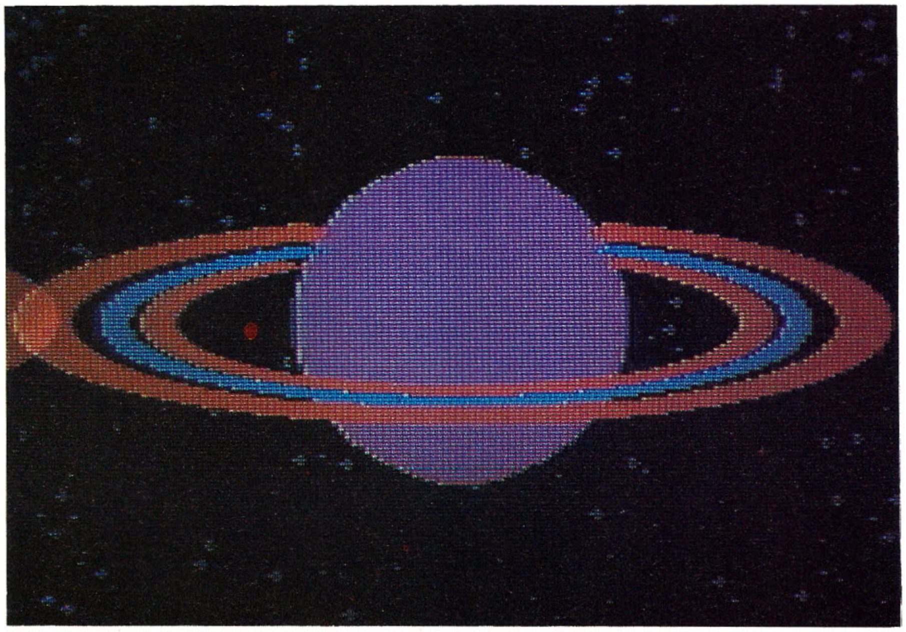
For the most demanding commercial, industrial, and scientific 8/16 bit applications, CPU 8085/88 is the answer. See the board that's more than a bridge between two worlds at finer computer stores and systems integrators world-wide.

Prices: $425 assembled (both CPUs run at 6 MHz), **$525** qualified under the **Certified System Component** high-reliability program (both CPUs run at 8 MHz). Call **415-562-0636** for the authorized **CompuPro** sales center near you, or for placing factory direct VISA® /Mastercard® orders. Prices do not include tax, shipping, or dealer support services (if applicable).

CompuPro™ division of **GODBOUT ELECTRONICS**

BOX 2355, OAKLAND AIRPORT, CA 94614

computer flexibility. The keyboard, for example, can be moved up to six feet away from the rest of the system. It can be held in your lap for comfort and ease of use. The components have a modern look but avoid the NASA laboratory look of some new computers. Like a stereo system, the Personal Computer would not be out of place in your living room.



The IBM's graphics demos are very impressive. (The overlapping at the left side of the photo resulted from a camera not a computer problem.)

The Soul of the Personal Computer

Technically, the IBM Personal Computer is a second-generation microcomputer. It uses the Intel 8088 16-bit microprocessor, which can address up to 256K bytes of user memory. The processor is driven by a 4.77 MHz clock and has a 410 nanosecond cycle time.

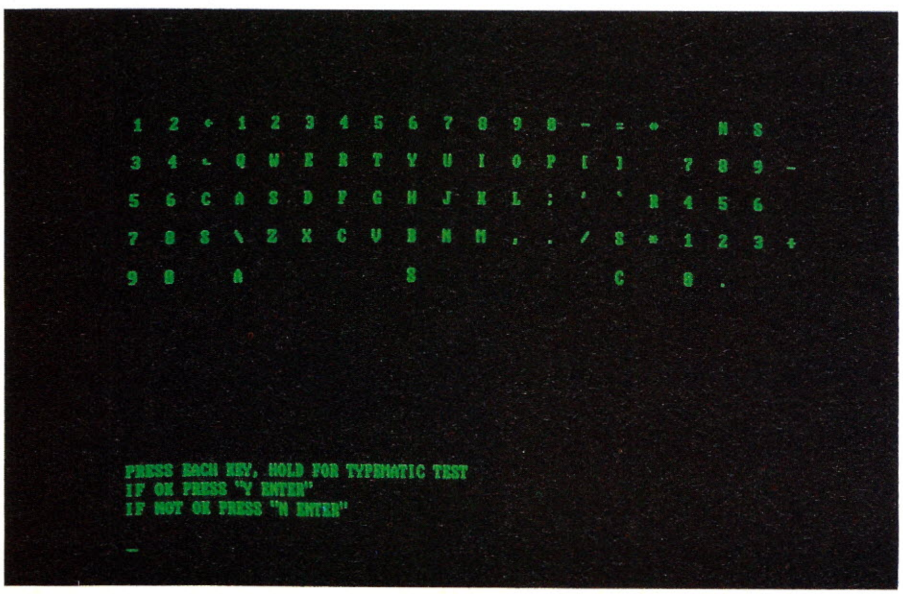
Because IBM elected to upgrade to a 16-bit processor for its new machine, the Personal Computer can open up new possibilities to the small computer user. 256K bytes of memory will allow four times as much data handling as the eight-bit machines that have been the microcomputer standard up to now.

It can, however, be configured with as little as 16K bytes of user memory. In this configuration it carries a modest $1595 price tag, bringing it well within reach of most homeowners and neophyte computerists. Since the system can be upgraded at any time, the minimum system will suffice to introduce many people to computers while allowing others to build a more powerful system for a specific application. Memory boards in 16K, 32K and 64K configurations are available to add to the system's power. These boards can be added by the owner. Simply plug them into slots inside the system unit. It is not necessary to have this upgrade performed by a dealer at additional cost.

The expansion slots in the system unit accept a variety of peripheral interfaces as well as additional memory. These include video-display adapters, allowing the use of an IBM monitor or a regular television set as a monitor; a printer adapter; communications adapter; and game adapter, the latter allowing the use of game paddles or joysticks. All these adapters add to the cost of the computer.

The Personal Computer has a built-in speaker for music programming or prompting. When the system is turned on, a diagnostics program in the computer's pre-programmed memory checks the components of the system to ensure that all the parts are functioning. The cassette tape player jack accepts all standard model cassette tape recorders. The 83-key keyboard contains ten special function keys and ten keys for numeric entry and cursor control—this numeric keypad must be activated before use. The enter or return key on the Personal Computer is marked only by a stylistic arrow that curves from the vertical to the left, a rather strange departure from traditional return key marking.

The data storage options include cassette tape and 5¼-inch floppy disks. The disk drive systems may be configured with one, two or four separate drives. The drives are double-density controlled, allowing 160K bytes of data per disk. The disk drives, like the expansion memory boards, can be installed by the user. The disks are formatted with 40 tracks, eight sectors per track and 512 bytes per sector. The disk drives, reportedly built by Tandon, have a power delay circuit built in that allows the system to be turned on and off with a disk in the drive. No damage can result to the disk because the



One of the Personal Computer's diagnostics tests the keyboard. As each key is pressed, its character appears on the screen if it is working properly.

↙See List of Advertisers on page 210

motors and read/write heads are not activated. (A problem might develop, however, if power fails in the middle of a read/write operation.)

The monitor made by IBM for use with the Personal Computer is a monochrome display that provides 25 lines of 80 characters on an 11½ inch green phosphor screen. The computer offers upper- and lower-case letter display and the monitor supports underlining, blinking characters and inverse video. Brightness and contrast controls allow adjusting the display for reading comfort. For color display, IBM offers a graphics/color monitor adapter that interfaces the computer to a color monitor, or an rf modulator that will permit the use of a standard color television set.

Many independent computer dealers were chagrined to discover three months ago that the new Epson MX-80 printers out of Japan had become hard to obtain. Now the reason for that scarcity has become evident. The dot matrix printer being sold by IBM with the Personal Computer is an Epson MX-80 with the IBM name on it. The fact that IBM chose this high-quality, low-cost printer to accompany its system is high praise for Epson, Ltd. The printer is bidirectional and prints 80 characters per second while offering expanded or compressed print. The printer also has overstrike capability to produce near letter-quality print.

Software from Everywhere

The IBM Personal Computer uses BASIC as its primary language. The BASIC interpreter, contained in a 40K preprogrammed memory, was written by Microsoft, Inc., of Bellevue, WA. Called BASIC80, Version 5.0, this BASIC, when combined with the disk BASIC enhancements known as advanced BASIC, is the most complete ever produced for microcomputers. The language includes a Graphics Macro Language and a Music Macro Language for the creation of sophisticated graphics and music routines. BASIC80 also supports the use of two printers simultaneously. Up to 16 foreground and eight background colors are supported by BASIC80. Significantly, the interpreter also allows the simultaneous display of color, graphics and character information.

If the BASIC interpreter used in the IBM Personal Computer has a fault, it is the syntactical requirement that spaces be placed between commands and numbers. It is required, for example, to have a space between GOSUB and 5000 or between the 1 and TO and TO and 1000 in the statement, FOR X=1 TO 1000. This is a mainframe BASIC holdover that IBM probably incorporated to appease its long-standing mainframe users, who the company hopes will become Personal Computer owners. Unfortunately, the spaces use memory and the syntax modification will take some adjustment on the part of people used to standard microcomputer BASICs that do not require the spaces. This will make life slightly more difficult for people who plan to adapt existing BASIC programs for

the Personal Computer.

The BASIC interpreter is about as fast as similar interpreters in the Apple and Radio Shack computers, printing the numbers 1 to 1500 in roughly 49 seconds. The system reset for the Personal Computer is a combination of the CTRL, ALT and DEL keys, pressed simultaneously—there is no simple reset switch like on many other computers.

To break the execution of a BASIC program, you must press the CTRL and break keys simultaneously. This extra keystroke should have been eliminated. The machine does have a PRT SC key which allows a dump of the screen buffer contents to the printer with a simple keystroke operation, an attractive feature that most computers lack.

Applications

In addition to BASIC in the preprogrammed memory, the IBM Personal Computer can run a variety of software packages under its CP/M-like operating system. IBM has a licensing arrangement with Digital Research, the originators of CP/M, to use a slightly modified version of the operating system under the name, IBM DOS. With this operating system, the company has also arranged licensing agreements with Personal Software, Peachtree Software, Microsoft, Inc., and Information Software Unlimited to sell VisiCalc, Accounting and General Ledger, Adventure game and the EasyWriter word processing software packages. Communication software is also available so that the computer can be used with a modem to communicate other computers and information services.

This software availability will certainly make the machine an attractive buy. But prospective buyers should be aware that none of these packages can run on a system with only 16K of user memory—Adventure needs 32K and the rest require 64K bytes of memory.

Price and Availability

The Personal Computer will not be inexpensive but, as a second-generation machine, it probably shouldn't be. With an IBM monochrome display, 64K of memory, printer and two disk drives, a system will cost about $4500. A 48K system with one disk drive and no printer will run $2295. Additional memory will cost $95 to $593. Software packages will run from $270 for VisiCalc to $995 for the Peachtree Accounting packages (all prices quoted are from Computerland).

IBM has promised that the machines will be available after Oct. 15. The Personal Computer will be sold through IBM Business Centers, Computerland stores and the new Sears Business Systems Centers. Speculation is that the company may announce eight-inch disk drives for the Personal Computer as early as February and eventually hard-disk drives.

Whatever happens, this new machine from an old company will have a substantial, but unpredictable, effect on an already volatile industry. ■

See List of Advertisers on page 210

The $99.95 personal computer.

Introducing the ZX81 kit

If you really want to save money, and you enjoy building electronic kits, you can order the ZX81 in kit form for the incredible price of just $99.95.* It's the same, full-featured computer, only you put it together yourself. We'll send complete, easy-to-follow instructions on how you can assemble your ZX81 in just a few hours. All you have to supply is the soldering iron.

How to order

Sinclair Research is the world's largest manufacturer of personal computers.

The ZX81 represents the latest technology in microelectronics, and it picks up right where the ZX80 left off. Thousands are selling every week.

We urge you to place your order for the new ZX81 today. The sooner you order, the sooner you can start enjoying your own computer.

To order, simply call our toll free number, and use your MasterCard or VISA.

To order by mail, please use the coupon. And send your check or money order. We regret that we cannot accept purchase orders or C.O.D.'s.

CALL 800-543-3000. Ask for operator #509. In Ohio call 800-582-1364. In Canada call 513-729-4300. Ask for operator #509. Phones open 24 hours a day, 7 days a week. Have your MasterCard or VISA ready.

These numbers are for orders only. For information, you must write to Sinclair Research Ltd., One Sinclair Plaza, Nashua, NH 03061.

sinclair

AD CODE KM	PRICE†	QTY.	AMOUNT
ZX81	$149.95		
ZX81 Kit	99.95		
8K BASIC chip (for ZX80)	39.95		
16K Memory Module (for ZX81 or ZX80)	99.95		
Shipping and Handling	4.95		$4.95
To ship outside USA add $10.00			
		TOTAL	

MAIL TO: Sinclair Research Ltd., One Sinclair Plaza, Nashua, NH 03061.

NAME ____________________

ADDRESS ____________________

CITY/STATE/ZIP ____________________

† U.S. Dollars

With stellar word processing features, Xerox's first microcomputer is destined to find a secure place in the business environment.

Another Industry Giant Takes a Micro Step

By Harold Nelson
Microcomputing Technical Editor

Last June Xerox released the Xerox 820 Information Processor, which is described as "a low-cost desktop work station that can be used as a word processing station, a business computer, or both." Sine its release the WORM (wonderful office revolutionary machine, Xerox's in-house code name for the 820) has undergone a name change to SAM (simply amazing machine).

Regardless of what it is called, the 820 deserves a serious look, if for no other reason (and there are other reasons) than the Xerox name it bears.

First Impressions

The first pleasant surprise is how easy the 820 is to set up and run. Connecting the components' cables to the ports on the display console is simpler than opening and unpacking the individual components. The instructions on setup are clear and almost unnecessary.

If the optional printer is to be a part of the system, its setup (removing protective shipping restraints and installing the printwheel) is only slightly more complicated. Again the instructions are clear and easy to follow.

Booting the system is a matter of turning on the console, inserting an operating system disk in drive A, typing the letter A and pressing return.

(If you want to use the 820 with a printer as an automatic typewriter, just type T. What you type is printed immediately. Unfortunately, it's not displayed on the console screen, which makes it nearly impossible to visually check what you have typed.)

Word Processing

The software package you've bought determines what will happen when you boot the system. In all likelihood, this will be the word-processing package, a CP/M-based version of MicroPro's acclaimed WordStar. The package contains two documents, the *Word Processing Handbook* and the *Word Processing Applications and Reference Guide*.

The *Handbook* gives you a clear and almost painstakingly detailed account of getting started. And it contains 15 tab-indexed pages of action and command summaries. But it does not tell you until page 43 that it is a good idea to make backup copies of your software disks. This is a simple process and is described on one of the tabbed pages at the back of the *Handbook*. Perhaps the *Handbook* is intended for the casual user who will not be involved with the system beyond using it as a word processor.

The first information in the *Applications and Reference Guide* is on making backup copies of software. In fact, the *Guide* is more complete in all respects. (One of the very first things you may want to do is run the diag-

The new 820 Information Processor—it is a Xerox. (Photo courtesy of Xerox Corp.)

nostic tests described in section 15.)

Once you've booted the system, made backup disks and performed diagnostic tests, you're ready to start processing some words. If this is your first time, the *Handbook* should prove very helpful. If you have some experience, you may need only the menus, and a help key that gives extensive instructions. Menus (see Table 1 for the main menu) are displayed at the top of the screen. But, if you want, you can eliminate these and use the full screen for text display.

Word processing features include:

- Search—For searching forward or backward through a document
- Find/Replace—To search for and replace a word any- or everywhere in an entire file, ignoring upper/lower case difference.
- Auto bold—For titles and so on
- Headers/trailers—For standard, multiline and alternating page headers and trailers
- Wordwrap—To automatically move a word that does not fit within the margins of a line down to a new line
- Copy/move—To move a block of text within a document or to a new document
- Auto centering—To center a line between the left and right margins
- Justification—To justify print to user-specified margins
- Underscoring
- Overstriking
- Super/subscripts—To print a half line above or below the current typing line

In the month or so that I've been using this package, I've been impressed by its power, versatility and ease of use.

CP/M and Other Software

If you intend to use the 820 for something else, you may want the CP/M package, which consists of the CP/M disk and two documents. CP/M opens many possibilities, since CP/M has virtually become a standard microcomputer operating system. The casual user need know nothing about CP/M to use it to load and run any of the many commercially available CP/M-based programs.

In addition to running programs under CP/M, the more knowledgeable user can modify or create new programs using CP/M features. These features are described in two documents, *CP/M Primer* and the *CP/M Manual.* Neither was prepared by

Brand-Name Shopping

By James H. Nestor

You don't realize how pervasive television is until you start to quote from TV commercials. I'm thinking of the one that features a series of salesmen trying to sell small office copy machines which are "just as good as a Xerox." The last salesman's final words are ". . . it *is* a Xerox!"

We have become a society of brand-name snobs. We buy an Oldsmobile instead of a Ford, and insist on Gloria Vanderbilt jeans. It is possible that many potential microcomputer users are waiting for an acceptable brand name to appear. As a consultant, I have met resistance from businessmen to buying a computer from Radio Shack or a company with a name such as Apple. What they seem to want is a name you can trust, something with a Fortune-500 ring to it.

Another Microcomputer—So What?

The Xerox 820 is certainly not the only new microcomputer on the market. I collected a huge stack of literature on new products at the National Computer Convention in Chicago. With a few exceptions, most of the new micros seem about the same. Aside from an occasional daydream about hard disks and remote terminals, I am content with my two-drive Radio Shack Model II and Daisy II printer.

Still, I scan the new products anoucements in several newsletters each week, looking for something truly new and exciting in the industry. The announcement of the Xerox 820 caught my attention. The elements which aroused my interest were the name Xerox, and the price—$2995.

Then I Met SAM

When I arrived at the local Computerland, I saw a colorful sign in the window inviting me to come in and "meet SAM." I learned that SAM stands for "simply amazing machine," the nickname which Xerox has given to the 820. I also noticed that all of the literature refers to the unit as the 820 Information Processor. The term Information Processor suggests that the 820 is not just a word processor, but a processor of words and data. In fact, SAM is a microcomputer, although that term is not used.

The 820 uses a Z-80A microprocessor, and includes 64K of RAM and 4K of ROM. It has dual 5¼-inch single-density drives, and a 24 line by 80 character white-on-black display screen. The machine includes two parallel I/O ports for keyboard and disk drives, and two serial ports for printer and modem.

The hardware is housed in three white cabinets. The display and keyboard cases are molded plastic with a pebble texture. The edges are nicely contoured. The disk drives are enclosed in a white metal cabinet. The power switch, reset button and display brightness control are all located beneath the lower edge of the monitor case, and thus are safe from accidental contact. The overall appearance is uncluttered and business-like.

The rear apron is equally clean. There are only four connectors and an ac line cord. The connectors are for keyboard, disk drives, printer and modem. The connecting cables are similar in appearance and size to RG-8 coax cable, and terminated with RS-232 connectors. The ac power for the disk drives is supplied by the cable from the monitor, eliminating the need for another line cord.

The keyboard can be moved about a foot from the monitor, a feature important in reducing fatigue. The keyboard, which re-

Address correspondence to James H. Nestor, MicroSolve, 39114 Route 303, Grafton, OH 44044.

(continued on p. 96)

```
        MAIN MENU                                             HELP = for assistance
  1 = go to menu            | 7 = delete this line           | E = change help level
  2 = block menu            | 8 = insert line here           | F = scroll up screenful
  3 = document menu         | 9 = insert mode(on/off)        | G = scroll down screenful
  4 = format(display)       | 0 = repeat next command        | J = find
  5 = format(nondisplay)    | = = scroll up line             | K = find & replace
  6 = reformat papagraph    | - = scroll down line           | L = repeat find & replace
--------------------------------------------------------------------------------------
     You may type now -or- give a command using CTRL + (any key shown above).
--------------------------------------------------------------------------------------
```

Table 1.

Xerox—the *Primer* is a Howard W. Sams book by Stephen Murtha and Mitchell Waite, and the *Manual* is almost entirely by Digital Research (producers of CP/M), with a few insertions by Xerox about the 820. Both describe such CP/M features included in the Xerox 820 version as the editor, the assembler (actually, this is the Digital Research 8080 assembler) and the dynamic debugging tool, but the *Manual* does so in more detail and includes alteration and interface guides. In addition, the *Manual* contains a few system notes on the 820 which will be helpful to the serious programmer.

Other Xerox 820 software currently or soon to be available includes Microsoft BASIC, CBASIC-II, an electronic worksheet package (probably VisiCalc) and a telecommunications package. According to Xerox, "Ethernet compatibility is provided through the previously announced Xerox 872/873 communications servers. The 820 can also use the Xerox 871 interactive communications emulator for 3270-mode access to a host computer."

Inside the 820

The Xerox 820 is a single-board microcomputer using the Z-80 processor (at 2.5 MHz) with 64K bytes of programmable random-access memory (RAM) and 4K bytes of read-only

(from p. 95)

sembles an office typewriter keyboard, has a comfortable feel. It includes two control keys and a key labeled Help.

A separate keypad includes numerals, decimal point, +, −, DEL (delete), ESC (escape), line feed and cursor control keys.

A printer is not included but is necessary for any serious use. All of the literature refers to the Diablo 630 printer, which came with the system I tested.

The Diablo 630 is bidirectional, and types 40 characters per second. It uses either plastic or metal daisywheels. You can use either single sheets or buy an optional tractor feed. Its retail price is $2900.

The System Software Is the Secret

Many microcomputer manufacturers, including IBM, DEC, Lanier and Honeywell, have chosen to sell both hardware and software. Consequently, they have limited the amount of available software. If the machine is dedicated to one purpose, such as word processing, the manufacturer's software may be adequate. But if the machine is to be used for other purposes, problems may arise. Software development is expensive and time-consuming. While software is being written, the customer may find himself with little more than an expensive paperweight shaped like a computer.

The 820 uses the CP/M 2.2 operating system. Since only minor changes are needed to run the same program on a range of CP/M-equipped microcomputers, the SAM user has a wide range of software open to him.

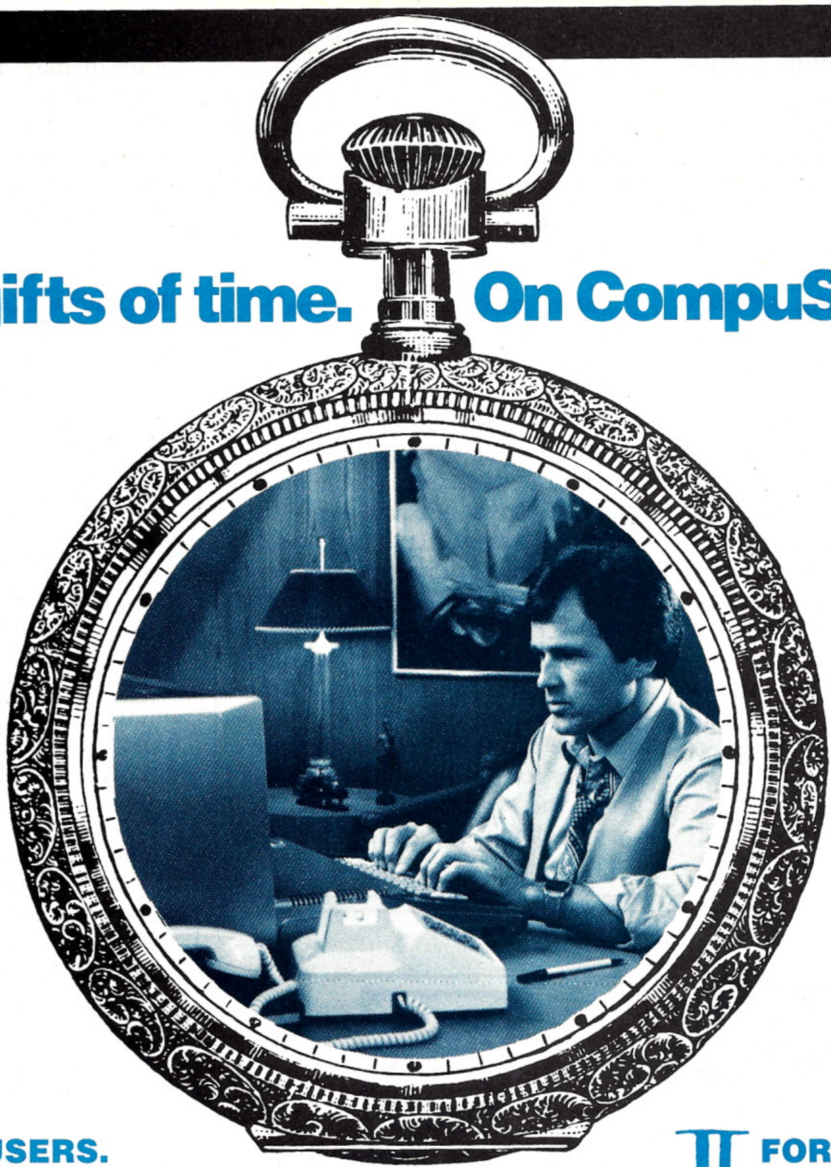
In addition to the CP/M software, the 820 package includes a diagnostic disk. A word processing program is a $495 option. Initially, Xerox will probably offer a limited selection of software. They are encouraging independent software developers to write quality software, rather than produce all of the software themselves.

First Comes Word Processing

With the Diablo 630 printer, SAM makes a first-class word processing system for about $6300. This places it significantly below the price of the new word-processing systems from IBM, Wang, Lan-

(continued on p. 98)

The gifts of time. On CompuServe.



I FOR NEW USERS.

CompuServe is in the holiday mode. If you subscribe to our system for the first time in November or December, we'll give you two free hours of CompuServe access time instead of one. That's a $10 savings just to get started. So get thee to a Radio Shack Store®, get a demonstration, then buy the Videotex software package for most popular computers ($29.95) or buy the system without software for "dumb" terminals ($19.95).

And . . . once you're a subscriber, you can clip the adjacent coupon and take advantage of our second "gift of time". Good deal? You bet!

BASIC MENU
• Electronic mail • Financial data & historical information • Special interest data • User newsletters • CB simulation • Newspapers • AP wire • Games • Plus, when you need it, languages, file creation & storage (128K free!), software downloading, other services. Over 130 separate entries on the current menu.

CompuServe 147

Information Service Division
5000 Arlington Centre Boulevard
Columbus, Ohio 43220
(614) 457-8600 (800) 848-8990

II FOR CURRENT SUBSCRIBERS.

You can give a friend and subscriber six hours or more connect time on CompuServe at a savings of 20 to 30% off the regular $5.00 per hour rate. See the adjacent coupon for actual gift certificate values. If you are your only friend with a computer or terminal, give yourself the gift. There will be lots of access time over the holidays, and these special low prices will let you or your friend connect with the fascinating world of the CompuServe Information Service at a substantial savings.

(from p. 96)

ier and Honeywell. With a letter-quality printer, those systems range from $7500 to over $10,000.

The word processing program is a variation of WordStar by Micro Pro. This is a good choice, since WordStar is considered by many to be the most powerful CP/M-based word processing software available.

The version of WordStar for the SAM has been customized for the system. For example, the delete key deletes one character to the right, and the cursor arrows move the cursor on the screen. Holding a key down for more than a second or so causes that key to repeat. I suspect that this is a hardware feature, since it isn't included in other versions of WordStar.

Pressing the Help key at any time produces instructions on the screen. Actually, it is a menu of menus, each with additional information about the program operation. WordStar has an elaborate system of help menus already. The addition of a specific Help key adds to a feeling of confidence when using the system. I expect that future software for the SAM will make use of this key. This is a step toward making micros more friendly.

The Manuals

Three manuals are included. The system includes the CP/M manual. Unfortunately, the first several chapters are from Digital Research, the company which owns the rights to CP/M. These are among the most unreadable documents I have encountered. The folks at Computerland had wisely inserted one of the newer guides to CP/M inside the binder. If Xerox must include the original CP/M documents, they might consider placing them in the back of the binder as an appendix.

Three chapters are written specifically for the SAM. The first explains the system tests performed by the diagnostic disk. They in-

(continued on next page)

memory (ROM). It provides 24 lines by 80 characters of memory-mapped video display. The 820 has a real-time clock, and uses the Western Digital 1771 disk-controller chip for floppy-disk I/O. The two parallel ports are used for the keyboard and the Shugart-compatible disk drives. There are two RS-232 serial ports, one designated for the optional printer and the other for communications.

The board and the interfaces are located in the same unit as the 12-inch black and white video display. The 96-character ASCII keyboard is a separate unit and includes a 20-key function and numeric pad. The standard 5¼-inch single-density disk drives are in a third unit (optional eight-inch drives are available).

Even though I'm impressed with the overall performance of the 820, it seems that it could have been even better. For example, why does the microprocessor run at 2.5 instead of 4 MHz, and why are single instead of double-density drives used?

Cost

The standard Xerox 820 system (console, keyboard and dual 5¼-inch drives) sells for $2995. The system with the optional serial printer (the excellent letter-quality Diablo 630) costs $5895. Optional eight-inch disk drives go for an additional $800.

The 820 is being sold at Xerox stores, and at additional retail outlets such as Computerland stores.

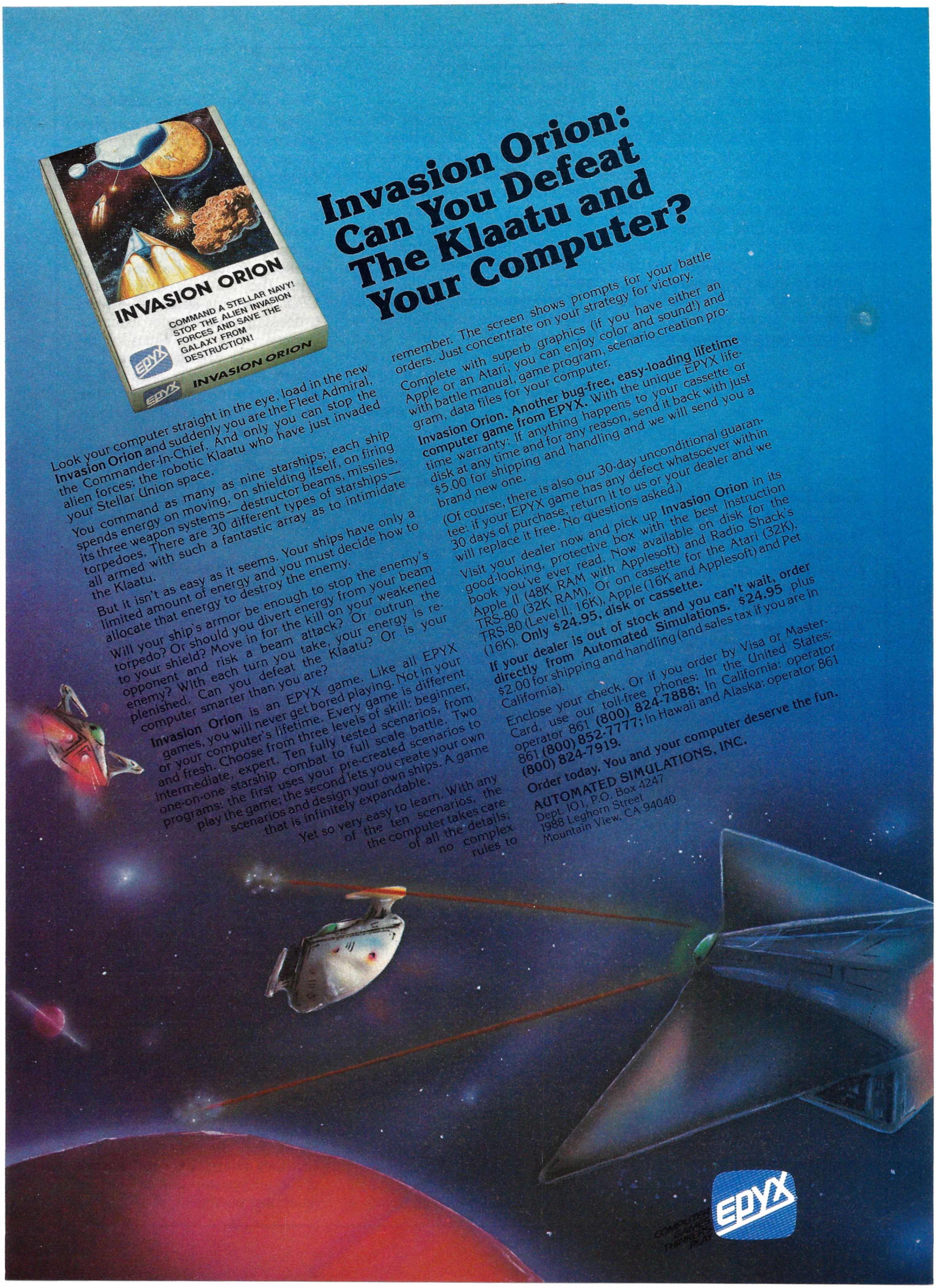
Conclusions

Xerox's new 820 Information Processor is not designed to be a home or hobbyist's computer. In fact, the 820 is not nearly as impressive as some other personal computers, such as Xerox's own Star, which costs three to four times as much as the 820.

Nevertheless, the 820 is a sound product that does what it was intended to do for the user it was designed for. And though it may not be a very flashy system, probably more important is the fact that it's very comfortable to use.

Xerox has given no consideration to games, color or graphics. But the 820 is a good choice for anyone who has to do a good deal of writing. A few 820 computers could be connected via a local network to share resources or a common printer.

The 820 is, as Xerox states, intended to be a word processing and business applications work station. At that it is a success. ■


INVASION ORION
COMMAND A STELLAR NAVY! STOP THE ALIEN INVASION FORCES AND SAVE THE GALAXY FROM DESTRUCTION!
EPYX
INVASION ORION
EPYX
Invasion Orion: Can You Defeat The Klaatu and Your Computer?
Look your computer straight in the eye, load in the new **Invasion Orion** and suddenly you are the Fleet Admiral, the Commander-In-Chief. And only you can stop the alien forces: the robotic Klaatu who have just invaded your Stellar Union space.
You command as many as nine starships; each ship spends energy on moving, on shielding itself, on firing its three weapon systems—destructor beams, missiles, torpedoes. There are 30 different types of starships—all armed with such a fantastic array as to intimidate the Klaatu.
But it isn't as easy as it seems. Your ships have only a limited amount of energy and you must decide how to allocate that energy to destroy the enemy.
Will your ship's armor be enough to stop the enemy's torpedo? Or should you divert energy from your beam to your shield? Move in for the kill on your weakened opponent and risk a beam attack? Or outrun the enemy? With each turn you take, your energy is replenished. Can you defeat the Klaatu? Or is your computer smarter than you are?
Invasion Orion is an EPYX game. Like all EPYX games, you will never get bored playing. Not in your or your computer's lifetime. Every game is different and fresh. Choose from three levels of skill: beginner, intermediate, expert. Ten fully tested scenarios, from one-on-one starship combat to full scale battle. Two programs: the first uses your pre-created scenarios to play the game; the second lets you create your own scenarios and design your own ships. A game that is infinitely expandable.
Yet so very easy to learn. With any of the ten scenarios, the computer takes care of all the details; no complex rules to remember. The screen shows prompts for your battle orders. Just concentrate on your strategy for victory.
Complete with superb graphics (if you have either an Apple or an Atari, you can enjoy color and sound!) and with battle manual, game program, scenario creation program, data files for your computer.
Invasion Orion. Another bug-free, easy-loading lifetime computer game from EPYX. With the unique EPYX lifetime warranty: If anything happens to your cassette or disk at any time and for any reason, send it back with just $5.00 for shipping and handling and we will send you a brand new one.
(Of course, there is also our 30-day unconditional guarantee: if your EPYX game has any defect whatsoever within 30 days of purchase, return it to us or your dealer and we will replace it free. No questions asked.)
Visit your dealer now and pick up **Invasion Orion** in its good-looking, protective box with the best instruction book you've ever read. Now available on disk for the Apple II (48K RAM with Applesoft) and Radio Shack's TRS-80 (32K RAM). Or on cassette for the Atari (32K), TRS-80 (Level II, 16K), Apple (16K and Applesoft) and Pet (16K). **Only $24.95, disk or cassette.**
If your dealer is out of stock and you can't wait, order directly from Automated Simulations. $24.95 plus $2.00 for shipping and handling (and sales tax if you are in California).
Enclose your check. Or if you order by Visa or Master-Card, use our toll-free phones: In the United States: operator 861 **(800) 824-7888;** In California: operator 861 **(800) 852-7777;** In Hawaii and Alaska: operator 861 **(800) 824-7919.**
Order today. You and your computer deserve the fun.
AUTOMATED SIMULATIONS, INC.
Dept. 101, P.O. Box 4247
1988 Leghorn Street
Mountain View, CA 94040
EPYX
COMPUTER GAMES THINKERS PLAY

clude two memory tests, a screen display test, a disk read/write test and a printer test for the Diablo 630. The chapter is well-written, illustrated and easy to follow. Properly used, the system tests should eliminate a few needless calls to the computer store.

The second chapter presents the Diablo 630 printer in considerable detail. While it is not a service manual, it does explain how the printer works. It certainly contains enough understandable information for the end user.

The purchaser of the 820 will be... a lawyer, a wholesaler, a CPA, a writer.

The third chapter contains some 24 pages of information about the 820 Information Processor. It includes a description of the system architecture, discusses the ROM monitor routines and lists addresses for subroutines. There are even pin-out diagrams of the I/O ports. Xerox does not intend to keep any secrets about the SAM. The only thing I didn't see mentioned was a description of the bus architecture.

The word processing manual contains the same chapters on the 630 and the 820 system, plus troubleshooting tips. Of course, it also includes information on operation of the word processing program. I didn't have time to examine this manual in detail, but it seems to be complete and readable.

The third manual is a pocket guide to the word processing program. It includes self-instructional material and illustrations. The last 15 pages or so are tab-indexed, and contain detailed instructions and examples. If, for example, you want to use boldface type, you can easily find the section on print enhancements in the index. This manual, combined with the help features, should make it easy for a new user to get started.

Other Features

When the machine is first turned on, the ROM monitor displays two options on the screen:

A—Boot System
T—Typewriter

Typing A and pressing the return key loads the system. The word processing disk automatically loads and executes. In fact, you don't need to exit to the operating system; you can read the disk directories, change disks and execute CP/M utilities such as STAT or PIP directly from the program menu.

The typewriter option is a ROM monitor function, and does not require a disk in either drive. It permits the unit to function from keyboard-to-printer, like a typewriter. Characters are not displayed on the monitor, but are printed directly on the printer.

While the inclusion of the Typewriter mode does not seem like much, it shows an awareness of the day-to-day routine in most offices. Frequently, the installation of a word processor does not eliminate the need for a regular office typewriter. It is not only overkill, but downright awkward to use WordStar to address envelopes or type shipping labels.

Who Is That Masked End-User?

I have repeatedly referred to the SAM end-user. Who is he or she? My impression is that the average purchaser of the 820 Information Processor will not be a computer hobbyist, who can find the hardware and software features of the SAM in several other machines. The board-level tinkerer can duplicate the system for less money. The more serious hobbyist can find a selection of more powerful hardware.

The purchaser of the 820 will be a business or professional person: a lawyer, a wholesaler, a CPA, a writer. He will be responsive to two things about the SAM: the brand name and the price.

I also predict that the average end-user will find a lot to like. The user who has previous word processing experience will find that the 820 offers many large system features at a fraction of the price. The person who has never tried computerized word processing will be amazed. Personally, I broke all of my #2 pencils and turned my typewriter into a planter.

What About Data Processing?

The 820 is billed as a complete information processor. That includes data as well as words. The system should function equally well in that area, based on the large number of CP/M programs available. The major limitation to serious data processing use is the limited amount of disk storage with the 5¼-inch drives. The CP/M operating system and word processing program, for example, occupy all but 9K bytes of the space on the first disk drive. That means that there is only 90K of data storage on the second drive. For all but the smallest operations, that is not enough.

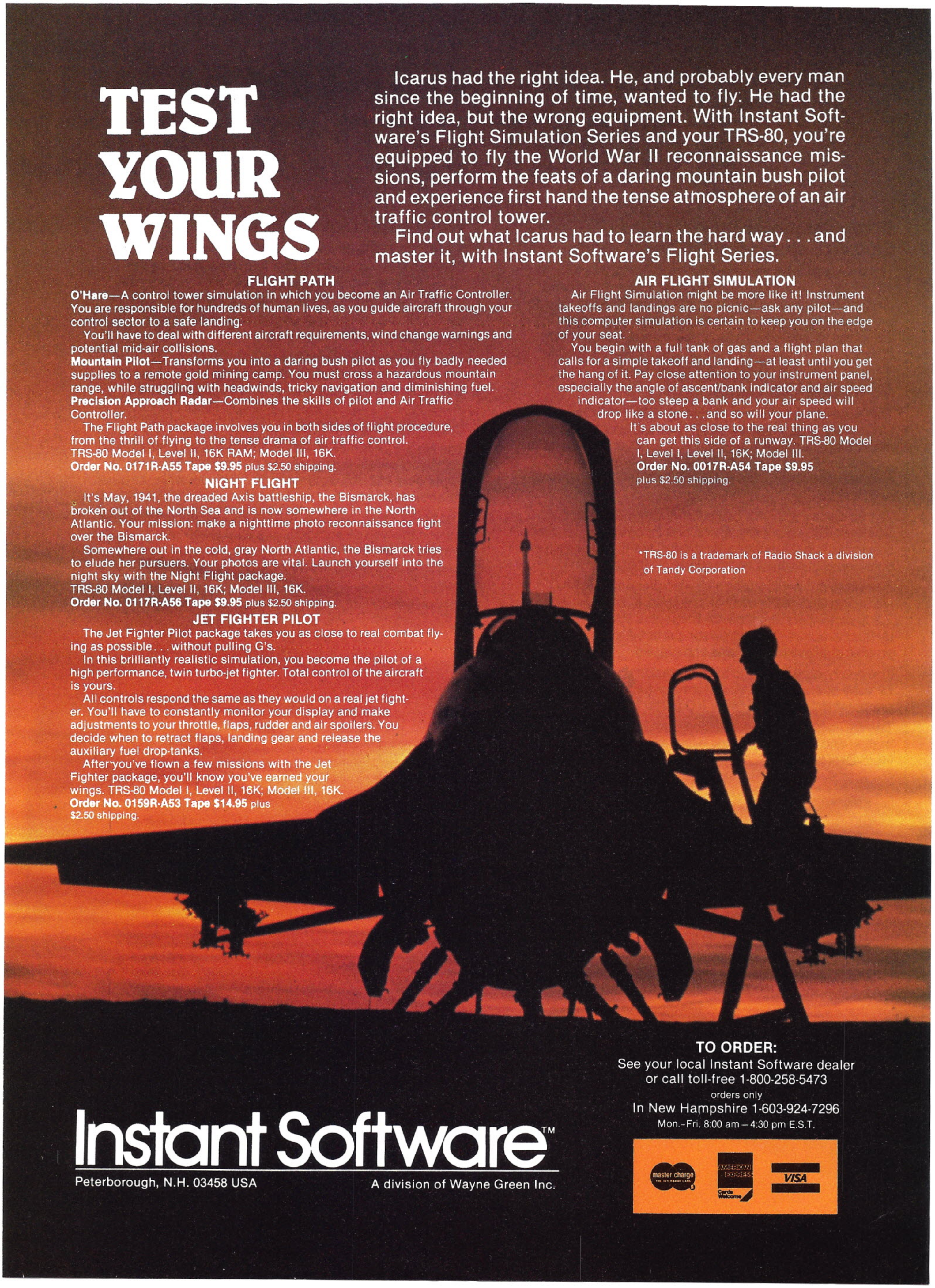
There is, however, an option to replace the dual 5¼-inch drive with dual eight-inch drives. Using single-sided, single-density formatting, that yields about 300K per drive, sufficient space for such software as the Peachtree accounting packages.

The fact that the new 820 is a Xerox product may be its most important feature.

Conclusions

It would seem that Xerox does not intend the 820 Information Processor to be the ultimate microcomputer. Rather, they see it as an affordable system for the entry-level user. It can also be an inexpensive component in a very complex and powerful automated office environment. The fact that the new 820 is a Xerox product may be its most important feature.

Certainly, some of the present micro manufacturers will resent the intrusion. Those of us with a broader perspective (and less capital invested) will welcome Xerox to the industry. The more systems sold, the more potential customers for software and services. And the more the public becomes aware of the importance of the microcomputer, the greater its impact on society.■



TEST YOUR WINGS
Icarus had the right idea. He, and probably every man since the beginning of time, wanted to fly. He had the right idea, but the wrong equipment. With Instant Software's Flight Simulation Series and your TRS-80, you're equipped to fly the World War II reconnaissance missions, perform the feats of a daring mountain bush pilot and experience first hand the tense atmosphere of an air traffic control tower.
Find out what Icarus had to learn the hard way . . . and master it, with Instant Software's Flight Series.
FLIGHT PATH
O'Hare—A control tower simulation in which you become an Air Traffic Controller. You are responsible for hundreds of human lives, as you guide aircraft through your control sector to a safe landing.
You'll have to deal with different aircraft requirements, wind change warnings and potential mid-air collisions.
Mountain Pilot—Transforms you into a daring bush pilot as you fly badly needed supplies to a remote gold mining camp. You must cross a hazardous mountain range, while struggling with headwinds, tricky navigation and diminishing fuel.
Precision Approach Radar—Combines the skills of pilot and Air Traffic Controller.
The Flight Path package involves you in both sides of flight procedure, from the thrill of flying to the tense drama of air traffic control.
TRS-80 Model I, Level II, 16K RAM; Model III, 16K.
Order No. 0171R-A55 Tape $9.95 plus $2.50 shipping.
NIGHT FLIGHT
It's May, 1941, the dreaded Axis battleship, the Bismarck, has broken out of the North Sea and is now somewhere in the North Atlantic. Your mission: make a nighttime photo reconnaissance fight over the Bismarck.
Somewhere out in the cold, gray North Atlantic, the Bismarck tries to elude her pursuers. Your photos are vital. Launch yourself into the night sky with the Night Flight package.
TRS-80 Model I, Level II, 16K; Model III, 16K.
Order No. 0117R-A56 Tape $9.95 plus $2.50 shipping.
JET FIGHTER PILOT
The Jet Fighter Pilot package takes you as close to real combat flying as possible . . . without pulling G's.
In this brilliantly realistic simulation, you become the pilot of a high performance, twin turbo-jet fighter. Total control of the aircraft is yours.
All controls respond the same as they would on a real jet fighter. You'll have to constantly monitor your display and make adjustments to your throttle, flaps, rudder and air spoilers. You decide when to retract flaps, landing gear and release the auxiliary fuel drop-tanks.
After you've flown a few missions with the Jet Fighter package, you'll know you've earned your wings. TRS-80 Model I, Level II, 16K; Model III, 16K.
Order No. 0159R-A53 Tape $14.95 plus $2.50 shipping.
AIR FLIGHT SIMULATION
Air Flight Simulation might be more like it! Instrument takeoffs and landings are no picnic—ask any pilot—and this computer simulation is certain to keep you on the edge of your seat.
You begin with a full tank of gas and a flight plan that calls for a simple takeoff and landing—at least until you get the hang of it. Pay close attention to your instrument panel, especially the angle of ascent/bank indicator and air speed indicator—too steep a bank and your air speed will drop like a stone . . . and so will your plane.
It's about as close to the real thing as you can get this side of a runway. TRS-80 Model I, Level I, Level II, 16K; Model III.
Order No. 0017R-A54 Tape $9.95 plus $2.50 shipping.
*TRS-80 is a trademark of Radio Shack a division of Tandy Corporation
TO ORDER:
See your local Instant Software dealer or call toll-free 1-800-258-5473
orders only
In New Hampshire 1-603-924-7296
Mon.-Fri. 8:00 am – 4:30 pm E.S.T.
Instant Software™
Peterborough, N.H. 03458 USA
A division of Wayne Green Inc.
master charge
AMERICAN EXPRESS Cards Welcome
VISA

HEATH/ZENITH A GIANT STEP FORWARD

Computer power, printer speed, hard disk storage – all in one system.

The three elements you need for smooth, rapid data handling are together now in one Heath/Zenith system. For word processing, business and financial applications, or custom programming – this is the performance standard evolving in computer technology. It's what you expect from a *strong partner.*

All-In-One Computer

The heart of the system is the Heath/Zenith 89 Computer, a complete, stand-alone unit with professional keyboard, smart video terminal and 5¼-inch disk drive. It's easy to use for people having little or no experience – yet it can also run extended languages like BASIC, COBOL, FORTRAN and Pascal.

The 89 comes with 48K bytes RAM, expandable to 64K. It has two Z80 microprocessors, one for computer functions, one for terminal functions. And three serial I/O ports for interface with printers and modem.

The video display features a 12-inch diagonal, high-resolution CRT that's easy on the eyes. It displays up to 2,000 characters at a time, 24 lines (plus 25th status line) by 80 characters, with full cursor control. Also 33 block graphic characters for charts and graphs.

The heavy-duty keyboard follows standard typewriter format for easy operator training. All terminal functions are programmable from keyboard or I/O ports.

The 5¼-inch floppy diskette stores 100K bytes of information and interfaces on line with the Heath/Zenith 67 Hard Disk System.

Winchester Disk System

The 67 Disk System features one hard disk and one 8-inch, soft-sectored floppy for total on-line storage of 10.782 megabytes (formatted). That's a huge data base.

The floppy is double-sided, double-density and can also operate in single-sided or single-density modes, compatible with standard IBM 3740 format.

The 67 features write-protect switches for both drives to prevent accidental erasure of information. The average access time of the hard disk drive is 70 milliseconds.

High-speed printer

The Heath/Zenith 25 Printer is a heavy-duty, high-speed, dot matrix printer that gives you sharp, clear printouts. It prints over 150 characters per second with whisper-quiet smoothness.

The entire 95-character ASCII set prints in upper case and lower case with descenders, in a 9 x 9 matrix. Also, 33 block graphic characters let you create graphs and charts. All functions and timing are microprocessor-controlled.

It uses standard edge-punched papers and features a convenient cartridge ribbon for easy, no-mess replacement.

ANNOUNCES
IN SYSTEM PERFORMANCE

Versatile software and accessories

The Heath/Zenith System offers you a choice of operating systems, including popular CP/M.

There are programs for word processing, business applications, and versatile utility functions. And the Heath User's Group offers a library of over 500 low-cost programs for home, work or play.

For your custom programs, Microsoft languages are available in BASIC (compiler and interpreter), FORTRAN and COBOL. Or learn to write and run your own programs with special self-study programming courses for Assembly, BASIC, Pascal or COBOL.

Free demonstration awaits you at your Heathkit Electronic Center

Pick the store nearest you from the list at right. And stop in today for a demonstration of the new Heath/Zenith System. If you can't get to a store, send $1.00 for the new Zenith Data Systems Catalog of assembled commercial computers and also receive free the latest Heathkit Catalog. Write to Heath Co., Dept. 351-844, Benton Harbor, MI 49022.

Visit Your Heathkit Electronic Center*

where Heath/Zenith Products are displayed, sold and serviced.

PHOENIX, AZ
2727 W. Indian School Rd.
602-279-6247

ANAHEIM, CA
330 E. Ball Rd.
714-776-9420

CAMPBELL, CA
2350 S. Bascom Ave.
408-377-8920

EL CERRITO, CA
6000 Potrero Ave.
415-236-8870

LA MESA, CA
8363 Center Dr.
714-461-0110

LOS ANGELES, CA
2309 S. Flower St.
213-749-0261

POMONA, CA
1555 N. Orange Grove Ave.
714-623-3543

REDWOOD CITY, CA
2001 Middlefield Rd.
415-365-8155

SACRAMENTO, CA
1860 Fulton Ave.
916-486-1575

WOODLAND HILLS, CA
22504 Ventura Blvd.
213-883-0531

DENVER, CO
5940 W. 38th Ave.
303-422-3408

AVON, CT
395 W. Main St. (Rt. 44)
203-678-0323

HIALEAH, FL
4705 W. 16th Ave.
305-823-2280

PLANTATION, FL
7173 W. Broward Blvd.
305-791-7300

TAMPA, FL
4019 W. Hillsborough Ave.
813-886-2541

ATLANTA, GA
5285 Roswell Rd.
404-252-4341

CHICAGO, IL
3462-66 W. Devon Ave.
312-583-3920

DOWNERS GROVE, IL
224 Ogden Ave.
312-852-1304

INDIANAPOLIS, IN
2112 E. 62nd St.
317-257-4321

MISSION, KS
5960 Lamar Ave.
913-362-4486

LOUISVILLE, KY
12401 Shelbyville Rd.
502-245-7811

KENNER, LA
1900 Veterans Memorial Hwy.
504-467-6321

BALTIMORE, MD
1713 E. Joppa Rd.
301-661-4446

ROCKVILLE, MD
5542 Nicholson Lane
301-881-5420

PEABODY, MA
242 Andover St.
617-531-9330

WELLESLEY, MA
165 Worcester Ave.
617-237-1510

DETROIT, MI
18645 W. Eight Mile Rd.
313-535-6480

E. DETROIT, MI
18149 E. Eight Mile Rd.
313-772-0416

HOPKINS, MN
101 Shady Oak Rd.
612-938-6371

ST. PAUL, MN
1645 White Bear Ave.
612-778-1211

BRIDGETON, MO
3794 McKelvey Rd.
314-291-1850

OMAHA, NE
9207 Maple St.
402-391-2071

ASBURY PARK, NJ
1013 State Hwy. 35
201-775-1231

FAIR LAWN, NJ
35-07 Broadway (Rt. 4)
201-791-6935

AMHERST, NY
3476 Sheridan Dr.
716-835-3090

JERICHO, L.I. NY
15 Jericho Turnpike
516-334-8181

ROCHESTER, NY
937 Jefferson Rd.
716-424-2560

N. WHITE PLAINS, NY
7 Reservoir Rd.
914-761-7690

CLEVELAND, OH
28100 Chagrin Blvd.
216-292-7553

COLUMBUS, OH
2500 Morse Rd.
614-475-7200

TOLEDO, OH
48 S. Byrne Rd.
419-537-1887

WOODLAWN, OH
10133 Springfield Pike
513-771-8850

OKLAHOMA CITY, OK
2727 Northwest Expressway
405-848-7593

FRAZER, PA
630 Lancaster Pike (Rt. 30)
215-647-5555

PHILADELPHIA, PA
6318 Roosevelt Blvd.
215-288-0180

PITTSBURGH, PA
3482 Wm. Penn Hwy.
412-824-3564

WARWICK, RI
558 Greenwich Ave.
401-738-5150

DALLAS, TX
2715 Ross Ave.
214-826-4053

HOUSTON, TX
1704 W. Loop N.
713-869-5263

SAN ANTONIO, TX
7111 Blanco Road
512-341-8876

MIDVALE, UT
58 East 7200 South
801-566-4626

ALEXANDRIA, VA
6201 Richmond Hwy.
703-765-5515

VIRGINIA BEACH, VA
1055 Independence Blvd.
804-460-0997

SEATTLE, WA
505 8th Ave. N.
206-682-2172

TUKWILA, WA
15439 53rd Ave. S.
206-246-5358

MILWAUKEE, WI
5215 W. Fond du Lac
414-873-8250

*Units of Veritechnology Electronics Corporation in the U.S.

Prices and specifications subject to change without notice.

HEATH/ZENITH

Your strong partner

You, too, may achieve enlightenment if you use this programming technique to tackle seemingly insolvable puzzles.

Recursion: Solving Age-Old Mysteries

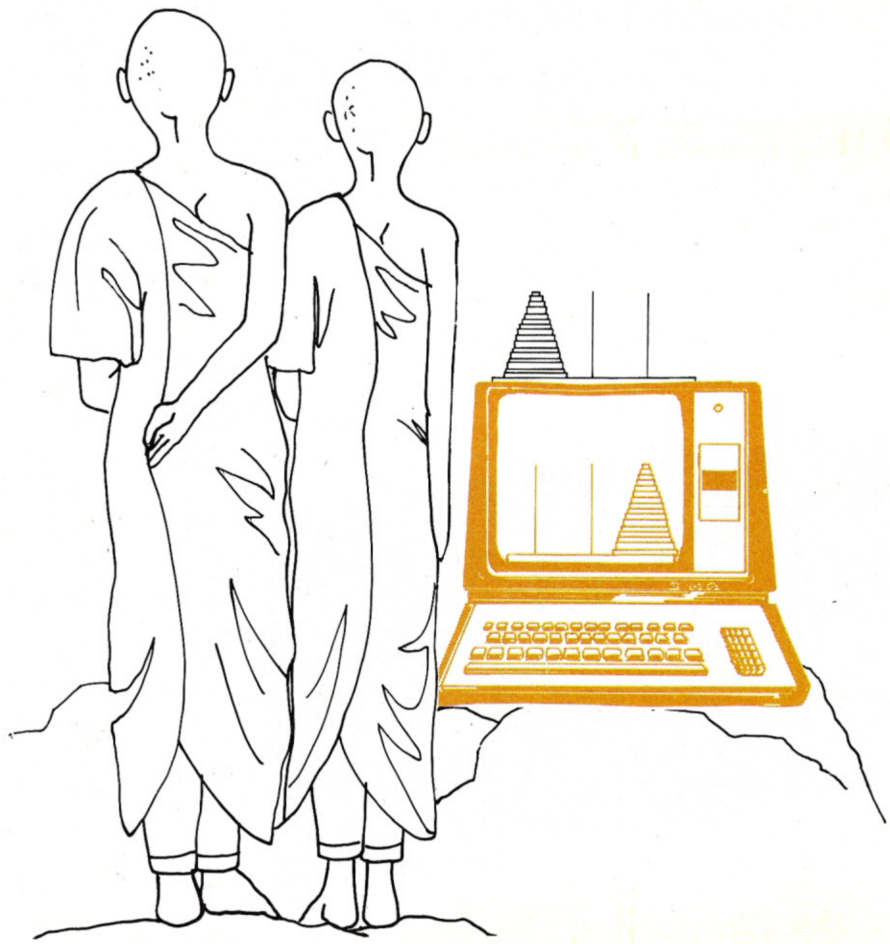
By Doug MacDonald

A thousand years ago, so the story goes, members of a sect of Buddhist monks were required to solve a strange puzzle on their long road to enlightenment.

Three diamond needles were mounted on a platform of brass. On one of these needles were stacked as many as 64 golden disks of decreasing size. The monks had to figure a way to move all the disks, one at a time, from the first needle to the third. The middle needle could be used to temporarily stack disks, but at no time could a larger disk be placed on top of a smaller disk.

Had these monks owned a modern digital computer—assuming the monastic powers would allow such devices on the premises—they could have used recursion to solve this problem in a snap.

The Towers of Hanoi problem, as the disk-moving puzzle has since become known, is a textbook example of this unique mathematical and programming technique called *recursion*.



A Definition

In classic terms, recursion means defining a problem or its solution in terms of itself. In programming, a recursive routine is one which calls itself—often over and over again.

To the novice, this seems like an outrageous form of cheating, a sort of algorithmic lifting yourself up by your own bootstraps. The programmer trying to understand a recursive procedure is more likely to see it as ancient Chinese nested boxes—boxes within boxes within boxes. Or perhaps as the Oriental snake devouring its own tail.

However mind-boggling, recursion allows elegant solutions to certain types of programming problems that would be awkward to solve by other means, and so it deserves some study. A number of high-level languages, such as Pascal, LISP and Logo, makes special provisions for use of recursive techniques.

Address correspondence to Doug MacDonald, Coast Projects Ltd., 124 Kingston St., Victoria, B.C., Canada V8V 1V4.

But before discussing programming examples, let's examine the process of recursion itself and see how it works.

Simplifying the Problem

The idea is to reduce the complexity of a problem by restating the problem in terms of itself, but with simpler conditions, until you reach a trivial and easily solved case of the original problem.

Take an example from mathematics. The factorial of an integer n—written n!—is defined as the number multiplied by all the integers below it down to 1. Thus, 4 factorial is 4 times 3 times 2 times 1. Factorials find wide use in statistics and other math fields.

The recursive way to look at factorials is to note that n factorial is equal to $n^*(n-1)$factorial. And $(n-1)$factorial, of course, equals $(n-1)^*(n-2)$ factorial. This redefinition continues until you reach the trivial case of (0)factorial, which is defined as 1.

Suppose you want to write a procedure to calculate the factorial of a given input N. In Pascal, for example, you might write a program such as that in Listing 1. This program requests a number to be input for N, then calculates N! and prints the result.

The actual calculation is performed by the recursive FACTCALC function. The value of N is passed to this procedure where it is first tested to see if it is equal to zero. If it is not, the value is passed to the next line which multiplies N times $N-1$ times $N-2$, etc., until zero is reached. This is accomplished by the procedure calling itself from within itself (FACTCALC: = N*FACTCALC(N – 1)). The procedure calls itself with the value of N decremented by one each time until N is zero. When N is zero the value of FACTCALC (i.e., N!) is printed.

Another example of a factorial procedure written in a language designed to directly handle recursion is given in Listing 2. This listing, in the Logo programming language, actually contains two procedures. The first calculates and prints the value of N!. The second procedure (READNUMBER) requests a number to be input, calls the first procedure and passes it the value input.

The first procedure (TO FACTORIAL :N :Q) calculates the factorial of input N. Input Q (which must be entered as 1) holds the values being calculated and at the end has the value of N!. (This procedure uses a slightly different factorial algorithm than that used by the Pascal program. The algorithm used here performs two multiplications at each level rather than one, reducing the number of times the procedure calls itself.)

The FACTORIAL procedure takes the value of N and tests to see if it is less than two. If N is two or greater, the procedure multiplies Q (one) by N by $N-1$ and gives this new value to Q. The procedure then calls itself, but this time with input $N-2$ instead of N and the new value of Q instead of one. It again tests the input to see if it is less than two. If it is, it prints the value of N! and stops. If the input is not less than two, the procedure continues calculating and calling itself until it is, and then it prints the result.

By now you're probably saying, "Never mind this Chinese boxes business; I could do the same thing just as well with a simple loop." Granted, many problems that can be solved with recursion are also suited to iterative techniques. However, observe that the above examples require no programming overhead of setting up and decrementing loop counters, saving partial products and so on. The intent is clear, and the expression is elegant.

Another example for mathematics might be the business of raising a number to a power. Many microcomputer languages do not provide an exponential instruction, leaving the programmer to write his own.

So, instead of seeing N^x as N*N*N*N . . . , you might observe that $N^x = N^*N^{(x-1)}$. Continuing to redefine, you would eventually reach the case where $x = 1$, and N^x is simply N. A recursive subroutine to do the job would contain a statement like:

NPOWER = N*NPOWER(N – 1)

Here again, a looping procedure could be worked out, but the recursive solution is clear and simple.

Other Uses

The above examples are trivial. More complex tasks, such as traversing a tree structure or calculating certain types of polynomials,[1] are often visible to the algorithm designer only in terms of recursion.

In a nonmathematical field, suppose you wanted to derive a clear set of grammatical rules for the English language (or any language, including computer languages).

One much-used method of expres-

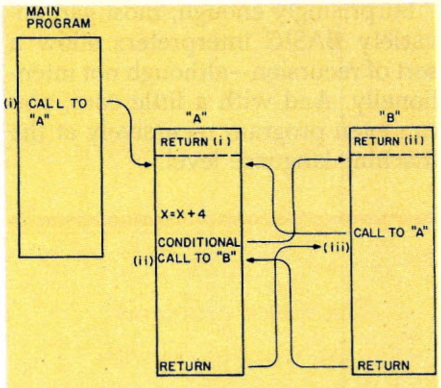


Fig. 1. Subroutine recursion.

sing language "grammars" is the Backus-Naur form (BNF). Each term or element of the grammar to be defined is followed by the symbol (:: =), which is read as "is composed of," plus a list of all possible subcategories of that term.

For instance, your English grammar might start:

SENTENCE :: = SUBJECT PREDICATE

meaning a sentence must contain two other grammatical forms called subject and predicate. You would then proceed to further break down these terms:

SUBJECT :: = NOUN|NOUN SUBJECT

Here you are saying that a subject is composed of a noun or a noun and a subject. (The vertical bar means "or.")

You'll notice that the definition of subject contains a reference to subject—exactly what is being defined! This is a recursive definition, and it is one which appears quite often in BNF.

The above example is a bit of a mind-twister at first glance, but in the end it's an efficient way of specifying that a subject may contain any number of nouns—such as "Fred and Harry and Peter and . . . ." (The "and" would also have to be accounted for in the grammar, usually by a part of speech called a determiner.)

Recursion has played an important role in recent advances by linguists, as well as in the field of computer language design. As mentioned earlier, a number of high-level languages allow recursive techniques. LISP, the list processing language, is almost entirely composed of recursive statements. Others, such as FORTRAN and COBOL, do not provide for recursion.

Recursion for the Millions

But what about the microcomputer hobbyist? What use can he or she make of recursion?

Surprisingly enough, most garden-variety BASIC interpreters allow a sort of recursion—although not intentionally. And with a little care, you can even program recursively at the machine-language level.

The major problems... are what to do with the current value of variables and...multiple return points.

I should mention that the above routines are examples of direct recursion. A further wrinkle can be added with indirect recursion.

Here the main program calls a subroutine—call it A—which calls a second subroutine, B. In turn, B makes a call back to A. The effect is still one of subroutine A calling itself; it just makes an extra step in doing so. Even more obscure would be subroutine A calling subroutine B, which calls subroutine C, which calls subroutine A; but this level of the snake eating its own tail is seldom seen.

The BASIC program in Listing 3 does exactly the same job as the Pascal and Logo programs and it uses the same algorithm shown in the Logo procedure. It is interesting to note that this program will run on virtually any computer with a BASIC interpreter capable of handling IF...THEN and GOSUB statements.

(Note: We tried the program in Listing 3 on a number of computers and it ran on every one, although on a few it was necessary to slightly modify lines 10 and 1000, which have nothing to do with the recursive character of the program. Commodore's VIC 20 with only 4K bytes of memory could calculate up to 23! before running out of memory. No other machine had memory problems, but they all had numeric overflow difficulties at one point or another. Most (Apple, PET and TRS-80) could handle numbers up through 33!, which isn't bad considering that 33! is about 8,683,317,618,811,886,000,000,000,000,000,000,000. The North Star Horizon went up to 49!. But if you feel some compulsion for calculating factorials on a personal computer, you will want to take a look at the Atari 800 or the TI 99/4A. The Atari could calculate 68!, and the TI with Extended BASIC when through 69!.)

The program along with the algorithm it uses is elegantly simple. (One word of caution: Be very careful of using GOSUB statements without corresponding RETURN statements. It usually won't work.) Line 10 asked for the number whose factorial you want to determine. Line 20 just sets the value of Q at one. The variable Q will represent the value of N!, and 0! and 1! both equal one.

The program then drops into the recursive subroutine (lines 500 through 530). First the value of N is tested. If it is less than two, the program goes to line 1000, which prints the result (in this case N! = 1) and ends the program. (The END in line 1000 could be changed to GOTO 10 if you absolutely have to find more than one factorial per sitting.)

If the value of N is two or larger, the program drops to line 510, which sets a new value of Q equal to the old Q (still one) times N times N – 1. Line 520 sets the value of N at the original value minus two, and line 530 sends this back to line 500. If N is now less than two, the result is printed; if not, a new value for Q is determined to the value of Q from the last round times the new value of N (the original value less two) times the new N minus one. N is now set to be two less than the value of N from the last round. The program again returns to line 500 and this newest value of N is tested. This continues until the value of N is less than two (0 or 1), at which time the final result is printed.

Line 530 of the subroutine functions something like the recursive calls in the Pascal and Logo procedures. This line calls the subroutine from within itself.

Problems

The stack is the key to recursion. Here, microcomputers have the advantage over some mainframe machines that do not have a hardware stack.

Why is the stack important? The major problems with handling recursive subroutines, which will call themselves an unknown number of times, are what to do with the current value of variables and how to keep track of multiple return points.

Consider Fig. 1, which shows a case of double recursion. The main program at some points makes a call to subroutine A. Assume for the moment that there is no stack in this particular machine; that a subroutine has within it a memory location to hold the return point, where it is supposed to return control after completion. Subroutine A then saves (i) as the location in the main calling program to which it will return control.

As it is executing, subroutine A encounters a call to subroutine B. As necessary, B stores (ii) as its return point back to A.

But now B makes a recursive call back to A. This time, subroutine A, not knowing that it has already been called once without completing its run, dutifully stores (iii) as its return point. Eventually, it returns to (iii) in B. Subroutine B continues until reaching its return instruction and passes control, as it should, to (ii). So far so good.

Then subroutine A completes its execution. But, instead of going back to (i) where it should, it passes control back to (iii) in subroutine B, which was the last return point stored. It's easy to see that there's an endless loop here, with control flickering back and forth between A and B, while you, the programmer, sit wondering just what went wrong.

Another problem arises with variables in a recursive routine. Look again at Fig. 1. Imagine that in A there is the assignment statement X = X + 4. Presumably, the main calling program wants just this action: for X to be returned four larger than it was. However, when A calls B, which in turn calls A again, the statement will be executed at least one extra time. So when A eventually passes control back to the main routine, X will actually be at least eight larger. This type of problem is extremely tough to track down.

The hardware stack is the natural way to solve the return point problem. Both machine and higher-level

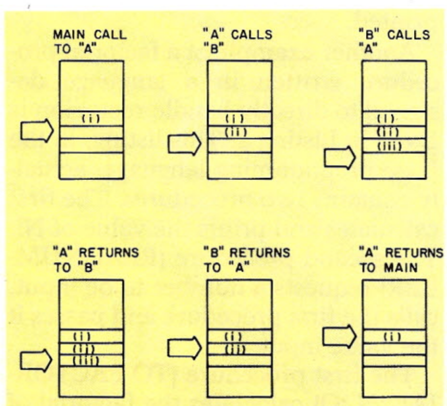
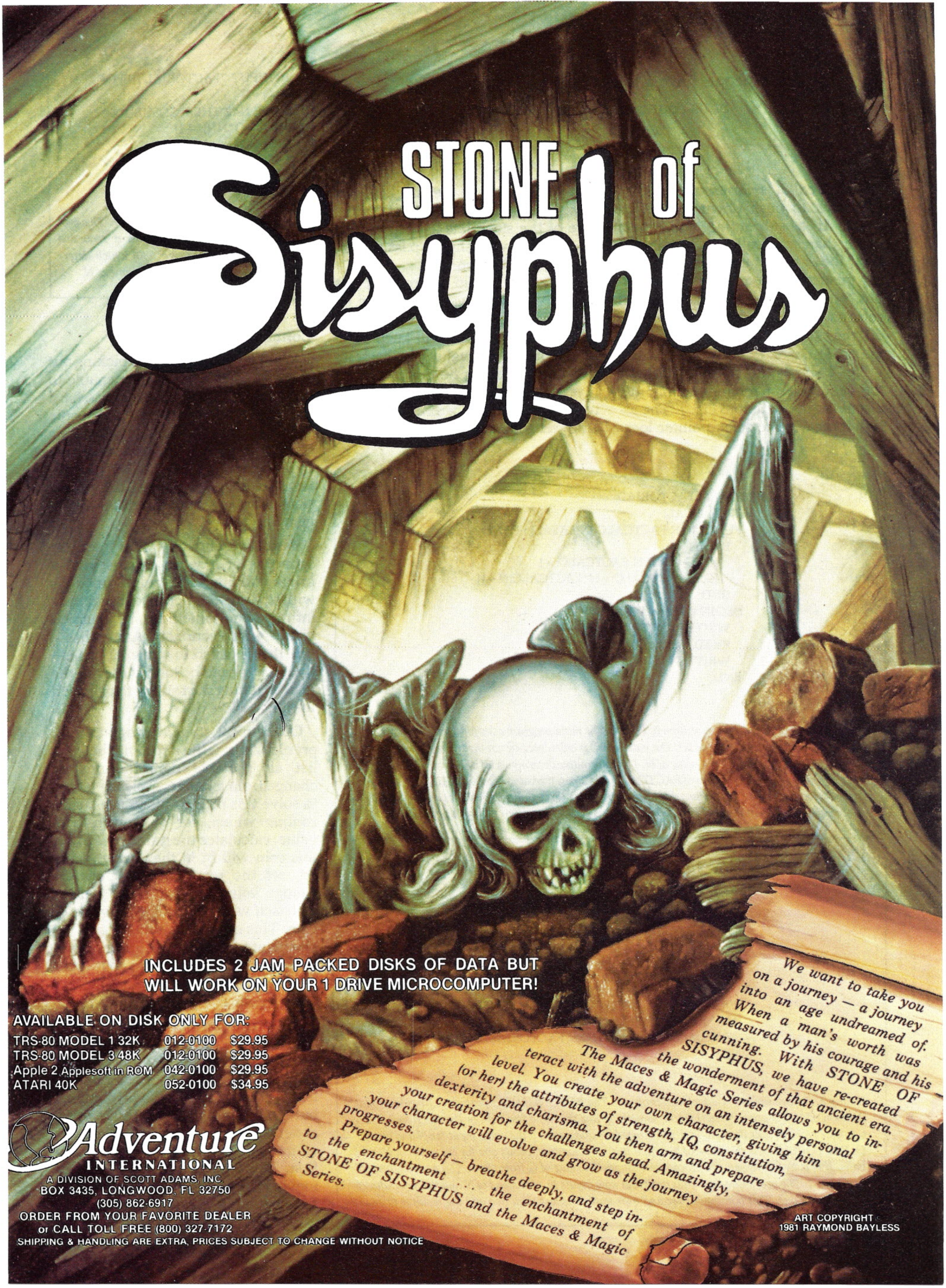


Fig. 2. Stacks shown throughout the sequence of recursive calls.

Reader Service for facing page ✓220→


STONE of
Sisyphus
INCLUDES 2 JAM PACKED DISKS OF DATA BUT
WILL WORK ON YOUR 1 DRIVE MICROCOMPUTER!
AVAILABLE ON DISK ONLY FOR:
TRS-80 MODEL 1 32K 012-0100 $29.95
TRS-80 MODEL 3 48K 012-0100 $29.95
Apple 2 Applesoft in ROM 042-0100 $29.95
ATARI 40K 052-0100 $34.95
We want to take you on a journey — a journey into an age undreamed of. When a man's worth was measured by his courage and his cunning. With STONE OF SISYPHUS, we have re-created the wonderment of that ancient era.
The Maces & Magic Series allows you to interact with the adventure on an intensely personal level. You create your own character, giving him (or her) the attributes of strength, IQ, constitution, dexterity and charisma. You then arm and prepare your creation for the challenges ahead. Amazingly, your character will evolve and grow as the journey progresses.
Prepare yourself — breathe deeply, and step into the enchantment ... the enchantment of STONE OF SISYPHUS and the Maces & Magic Series.
Adventure
INTERNATIONAL
A DIVISION OF SCOTT ADAMS, INC.
BOX 3435, LONGWOOD, FL 32750
(305) 862-6917
ORDER FROM YOUR FAVORITE DEALER
or CALL TOLL FREE (800) 327-7172
SHIPPING & HANDLING ARE EXTRA, PRICES SUBJECT TO CHANGE WITHOUT NOTICE
ART COPYRIGHT © 1981 RAYMOND BAYLESS

Some people have a talent for recursion, but most of us count on fingers and toes.

language *call. . . return* sequences use the stack to push down the return point. If a subroutine encounters more than one call before completion, the extra return points are simply pushed down on top of the previous ones; during the sequence of returns, these addresses are popped off the stack in reverse order—just the order needed.

Fig. 2 shows the stack throughout the sequence of recursive calls just discussed in relation to Fig. 1. The arrow indicates the stack pointer location (assume that the stack grows downwards). The last-in, first-out nature of the stack lets it keep perfect track of just who should pass control to whom and when.

The way to avoid unexpected loss or overwriting of variables—side effects—in recursive routines is to ensure that the routine will keep separate copies of the values for each invocation. This can be done with arrays, or use the stack to push temporary values, being careful not to destroy return points.

```
PROGRAM FACTORIAL;
  VAR N : REAL;
    FUNCTION FACTCALC (N : REAL) : REAL;
      BEGIN
        IF N=0 THEN FACTCALC:=1
        ELSE FACTCALC:=N*FACTCALC(N-1)
      END;
    BEGIN (*MAIN PROGRAM*)
      WRITE ('FACTORIAL (N!) OF ');
      READLN (N);
      WRITELN ('N!=',FACTCALC(N))
    END.
```

Listing 1. A factorial program written in Pascal. The main program asks for a value of N to be input and then prints the value of N!. The value of N! is calculated by calling the recursive function FACTCALC and passing it the value of N. This subroutine determines N! by testing whether or not N is zero. If not, it sets the value of FACTCALC at N times the value of FACTCALC(N–1), which is the factorial of N–1. This means it is necessary to back through FACTCALC again and again until N equals 0, at which point FACTCALC equals N! and the main program prints that value.

```
TO FACTORIAL :N :Q
  IF :N<2 THEN PRINT1 "N!= PRINT :Q STOP
  MAKE "Q :Q*N*(N-1)
  FACTORIAL :N-2 :Q
END

TO READNUMBER
  PRINT1 SENTENCE [FACTORIAL (N!) OF] []
  MAKE "INPUT FIRST REQUEST
  IF NUMBER? :INPUT THEN FACTORIAL :INPUT 1
END
```

Listing 2. A Logo version of a factorial program. The READNUMBER procedure (thanks to Hal Abelson of MIT's Logo Project) works something like the main program in Pascal. It requests a value for N, then calls the FACTORIAL procedure and passes it the value input for N and one for Q. FACTORIAL tests the value of N and, if it is less than two, prints one for the value of N! and halts. If N is two or larger, the procedure changes the value of Q from one to Q (i.e., one) times N times N–1. The procedure then calls itself, but now inputs N–2 instead of N and the new value of Q instead of one. This continues over and over until N is less than two and the result is printed.

```
10 INPUT "FACTORIAL (N!) OF "; N
20 Q=1
500 IF N<2 THEN GOSUB 1000
510 Q=Q*N*(N-1)
520 N=N-2
530 GOSUB 500
1000 PRINT "N!="; Q: END
```

Listing 3. A BASIC factorial program. This program, like the others, contains a recursive routine (lines 500 through 530) which determines the factorial of an input number N.

Conclusions

What do you look for in picking out computer tasks that are amenable to recursive solution? There are no hard and fast guidelines. Some people seem to have a native talent for *seeing* recursion, an intuitive understanding of its intricacies. Most of us, though, have to struggle through, scribbling state diagrams and counting on fingers and toes.

Basically, any task that requires summing or a series expansion is a prime candidate. Calculus functions with a parameter approaching zero or infinity can sometimes be handled nicely with recursion. Any subroutine that is called in a regular, repetitive way should be looked at with the idea of getting the routine to call itself until its task is done.

One typical student programming problem is to write a routine that will list all possible combinations of change from a dollar. A pleasing way to solve this problem is to use a subroutine which, for any given coin value, calculates the number of times this coin will fit in the change needed, set the remainder as the new change value and have the routine call itself with the next lower value of coin. This might be an interesting experiment to test your BASIC interpreter's recursive capabilities, but don't be disappointed if stack overflow causes your computer to freeze up.

Now that you have a basic understanding of recursion, you might like to get one up on the Buddhist monks and solve the Towers of Hanoi problem. I won't tell you how it's done, but I'll give you a hint. Don't think about the top disk on the first needle, which will be one you would move first. Think about the trivial case of moving the bottom disk from needle 1 to needle 3 and proceed from there.

May you achieve enlightenment! ■

SANTA'S GONE SOFT . . .

TRS-80* BUSINESS AND APPLICATIONS

ORDER NO.	PROGRAM NAME	PRICE
0316RD	Climate Comp (Disk)	24.95
0287R	Electronic Breadboard (Tape)	49.95
0258RD	Find It Quick (Disk)	49.95
0168R	Label (Tape)	24.95

TRS-80* UTILITIES

ORDER NO.	PROGRAM NAME	PRICE
0246R	Compression Utility Pack (Tape)	19.95
0232R	The Disassembler (Tape)	9.95
0180RD	Disk Editor (Disk)	39.95
0139RD	Disk Scope (Disk)	19.95
0231RD	DLDIS (Disk)	19.95
0228R	Dynamic Device Drivers (Tape)	19.95
0199RD	Dynamic Device Drivers (Disk)	24.95
0250R	Irv (Tape)	24.95
0350RD	Irv (Disk)	29.95
0058R	Programmer's Converter (Tape)	9.95
0245R	Programmer's Primer (Tape)	9.95
0133R	Renum/Compress (Tape)	14.95
0230R	TLDIS (Tape)	14.95
5003R	Ultra-Mon (Tape)	24.95

TRS-80* EDUCATION

ORDER NO.	PROGRAM NAME	PRICE
0136R	Beginner's Russian (Tape)	9.95
0137R	Everyday Russian (Tape)	9.95
0071RD	Geography Explorer: USA (Disk)	49.95
0212RD	Russian Disk (Disk)	24.95
0127R	Surveyor's Apprentice (Tape)	9.95
0214RD	Teacher's Aide (Disk)	39.95
0099R	Typing Teacher (Tape)	12.95

TRS-80* GAMES, SIMULATIONS AND ENTERTAINMENT

ORDER NO.	PROGRAM NAME	PRICE
0017R	Air Flight Simulation (Tape)	9.95
0106R	Airmail Pilot (Tape)	9.95
0240R	Alien Attack Force (Tape)	9.95
0213RD	The All Stars (Disk)	34.95
0051R	Ball Turret Gunner (Tape)	9.95
0141R	Battleground (Tape)	9.95
0223R	Cosmic Patrol (Tape)	14.95
0224RD	Cosmic Patrol (Disk)	19.95
0237R	Danger In Orbit (Tape)	14.95
5006R	Dragonquest (Tape)	15.95
5007RD	Dragonquest (Disk) Model I	21.95
5010R3D	Dragonquest (Disk) Model III	21.95
0218R	Dr. Chips (Tape)	9.95
0171R	Flight Path (Tape)	14.95
0205RD	The Flying Circus (Disk)	39.95
0219R	House of 30 Gables (Tape)	9.95
0159R	Jet Fighter Pilot (Tape)	14.95
0378RD	Master Reversi (Disk)	29.95
0117R	Night Flight (Tape)	9.95
0023R	Oil Tycoon (Tape)	9.95
0120R	Perfect Pong (Tape)	14.95
0043R	Santa Paravia & Fiumaccio (Tape)	9.95
0332R	Space Shuttle (Tape)	14.95
0312R	Swamp War (Tape)	14.95
5012R	Temple of the Sun (Tape)	19.95
5011RD	Temple of the Sun (Disk) Model I	29.95

TRS-80* HOME AND PERSONAL

ORDER NO.	PROGRAM NAME	PRICE
0084R	Music Master (Tape)	9.95
0151RD	QSL Manager (Disk)	19.95

APPLE** EDUCATIONAL

ORDER NO.	PROGRAM NAME	PRICE
0339AD	Capitalization (Disk)	34.95
0283AD	Russian Disk (Disk)	24.95

APPLE** GAMES, SIMULATIONS & ENTERTAINMENT

ORDER NO.	PROGRAM NAME	PRICE
0148A	Air Flight Simulation (Tape)	9.95
0161AD	Apple Fun (Disk)	19.95
0254AD	Dr. Chips (Disk)	14.95
0018A	Golf (Tape)	9.95
0025A	Mimic (Tape)	9.95
0079A	Oil Tycoon (Tape)	9.95
0163AD	Paddle Fun (Disk)	19.95
0080A	Sahara Warriors (Tape)	9.95
0174A	Santa Paravia & Fiumaccio (Tape)	9.95
0229AD	Santa Paravia & Fiumaccio (Disk)	19.95
0183A	Skybombers II (Tape)	9.95
0271AD	Skybombers II (Disk)	19.95

APPLE** HOME AND PERSONAL

ORDER NO.	PROGRAM NAME	PRICE
0235AD	Solar Energy for the Home (Disk)	34.95
0242AD	Astrology (Disk)	19.95

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

TO ORDER:

See your local Instant Software dealer
or call toll-free 1-800-258-5473 Dept. A-64
In New Hampshire 1-603-924-7296 Dept. A-64

Mon.-Fri. 8:00 am – 4:30 pm E.S.T.

Include 2.50 for Shipping & Handling.

master charge THE INTERBANK CARD · AMERICAN EXPRESS · VISA

Instant Software™

Peterborough, N.H. 03458 USA

A division of Wayne Green Inc.

*TRS-80 is a trademark of Radio Shack a division of Tandy Corporation
**APPLE is a trademark of Apple Computer Inc.

"I see Instant Software in your future..."

"....It's becoming very clear now... Your microcomputing life is going to be very exciting...Money! I see much money for you. Perhaps it is the money you will gain when Instant Software's new business applications guide your financial endeavors. I see travel...you will journey to distant worlds in distant times. You will build kingdoms from deserts and armies from slaves. Never will you be bored, adventurous one! Your programming burdens will lighten with new utilities—new tools. I see color! Many bright colors! I see new packaging for all these treasures...everything new! And...yes, a tall, handsome stranger who will guide you to these wonders. It will be your Instant Software dealer—a wise one indeed. All awaits you—all is yours for the asking. Soon...very soon!"

Get a glimpse of the future today—at your nearest Instant Software dealer.

ALABAMA
THE COMPUTER SHOP, Gadsden
ALASKA
COMPUTER TALK, Anchorage
JUNEAU ELECTRONICS, Juneau
WAPATCO, Anchorage
ARIZONA
COMPUTER STORE, Phoenix
MESA ELECTRONICS, Mesa
MILLET'S ELECTRONICS, Mesa
PERSONAL COMPUTER PLACE, Mesa
SIMUTEK, Tucson
SOFTWARE STATION, Tempe
TOY BOX, Sierra Vista
ARKANSAS
MICRO COMPUTER SYSTEMS, Hot Springs
CALIFORNIA
ADVANCE RADIO (R/S DEALER), Grass Valley
ADVANCED COMPUTER PRODUCTS, Santa Ana
ALLTRONICS, San Jose
AMCO ELECTRONIC SUPPLY, Azusa
ASAP COMPUTERS, Signal Hill
BYTE INDUSTRIES, Hayward
BYTE SHOP, Mountain View
CAPITOL COMPUTER SYSTEMS, Sacramento
COAST ELECTRONICS, Morro Bay
COMPUSOUND, Orange
COMPUTER MART OF CALIFORNIA, INC., Diamond Bar
COMPUTER PLUS, Sunnyvale
COMPUTER STORE, San Leandro
COMPUTER WORLD, Westminster
DEROSEAR APPLIANCE & REPAIR, Weaverville
DIMENSIONAL SOFTWARE, San Diego
EXATRON, Santa Clara
GAME-O-RAMA, Santa Barbara
GRAY MATTER, San Francisco
HOBBY WORLD ELECTRONICS, Northridge
HUNTINGTON COMPUTING, Corcoran
MALIBU MICROCOMPUTING, Malibu
MICRO SPECIALTIES, Daily City
MN&T INDUSTRIES, Lompoc
OPAMPTECHNICAL BOOKS, Los Angeles
OPPORTUNITIES FOR LEARNING, Chatsworth
PC COMPUTERS, El Cerrito
Q I COMPUTERS, INC., Lawndale
RAC PRODUCTS, San Jose
RADIO SHACK, El Cajon
RADIO SHACK, Palm Springs
RADIO SHACK, San Diego
R&V SOUND (R/S DEALER), Fortuna
SALINAS HOBBY CENTER, Salinas
SHAVER RADIO, San Jose
SILVER SPUR ELECTRONICS, Chino
SOFTWARE PLUS, El Toro
STACEY'S BOOKSTORE, San Francisco
STRAWFLOWER ELECTRONICS (R/S DEALER), Half Moon Bay
THE COMPUTER STORE, Santa Monica
THE FEDERATED GROUP, Commerce
THE SOFTWARE STORE, Huntington Beach
WABASH APPLE, El Toro
WARRIORS, WIZARDS & ROBOTS, Garden Grove
WENNER BUSINESS SYSTEMS, Los Altos
COLORADO
APPARAT, Denver
FISTEL'S MICRO ELECTRONICS, Denver
POOR RICHARD'S CALCULATORS, Fort Collins
SOFTWARE GOURMET, Denver
CONNECTICUT
AMERICAN BUSINESS COMPUTERS, Groton
BYTE ME COMPUTER SHOP, New London
COMPUTER LAB, New London
INSTRUCTIONAL SYSTEMS COMPUTERS, Manchester
TECHNOLOGY SYSTEMS, Bethel
THE COMPUTER STORE, Stamford
DELAWARE
MICRO PRODUCTS, Wilmington
OMNIFAX, Wilmington
DISTRICT OF COLUMBIA
THE PROGRAM STORE, Washington, D.C.
FLORIDA
ADVENTURE INTERNATIONAL, Casselberry
ALL SYSTEMS GO, Winter Garden
AMF MICROCOMPUTER CENTER, Tampa
COMPUTER CENTER, West Palm
COMPUTER JUNCTION, Fort Lauderdale
COMPUTER WORLDS, Clearwater
COMPUTERLAND, Jacksonville
COMPUTERLAND, Sarasota
COMPUTERLAND, Tampa
COMPUTERLAND, West Palm Beach
HEATHKIT ELECTRONIC CENTER, Hialeah
H&H HOBBY SALES, Sarasota
MICROCOMP LTD., Miami
MICROCOMPUTER SYSTEMS INC., Tampa
MINI CONCEPTS, Holly Hill
SAV-A-BYTE, Jacksonville
SOUND IDEAS, Gainesville
SOUTH EAST MICRO DATA, Orlando
GEORGIA
ATLANTA COMPUTER MART, Atlanta
BAILEY'S COMPUTER SHOP, Augusta
DELTA DATA DYNAMICS, Tucker
ENERGY LOGIC, Columbus
FLEMING DRUG CO., Wrens
HAWAII
HONOLULU ELECTRONICS, Honolulu
MILLS ELECTRONICS, Lahaina
RADIO SHACK ASSOC. STORE, Honolulu
IDAHO
DENNIS STONE ENTERPRISES, Fruitland
ELECTRONIC SPECIALTIES, Boise
R&L DATA SYSTEMS, Idaho Falls
ILLINOIS
ALPINE COMPUTER CENTER, Rockford
BELL ELECTRONICS, Edinboro
CHICAGO MAIN NEWSTAND, Evanston
COMPREHENSIVE MICRO SYSTEMS, Chicago
COMPUTER JUNCTION, Elmhurst
COMPUTER STORE, Rockford
COMPUTERLAND, Niles
CREATIVE PROGRAMMING, Charleston
GARCIA & ASSOCIATES, Chicago
ILLINOIS CUSTOM COMPUTERS, Harrisburg
MAIN STREET COMPUTER CO., Decatur
MIDWEST MICRO COMPUTERS, Lombard
THE PILOT HOUSE, Gladstone
WALLACE COMPUTERS, Peoria
INDIANA
ABC HOBBY, Evansville
DIGITAL TECHNOLOGY, Lafayette
FALL CREEEK ELECTRONICS, Pendleton
GAME HUT, Bloomington
GAME PRESERVE, Indianapolis
PROFESSIONAL MICROCOMPUTER SOFTWARE, Muncie
SIMONTON LAKE DRUGS, Elkhart
THE BOARDROOM, Indianapolis
THE HAM SHACK, Evansville
IOWA
LENWOOD SYSTEMS, Center Point
MEMORY BANK INC., Bettendorf
SERNETT LEISURE CENTER, Carroll
KANSAS
AMATEUR RADIO EQUIPMENT, Wichita
CENTRAL KANSAS COMPUTERS, Herington
COMMUNICATIONS CENTER, Lincoln
GOSUB INTL, Wichita
HATCH COMPUTER CENTER, Alliance
HIGH TECHNOLOGY, Wichita
KENTUCKY
COMPUTER MAGIC, Louisville
PERRY'S COMPUTER, Bremen
LOUISIANA
ACME BOOK CO., Baton Rouge
COMPUTER SHOPPE, Metairie
MAINE
FRYEBURG COMPUTER CENTER, Fryeburg
MAINE MICRO SYSTEMS INC., Auburn
MID-MAINE COMPUTER COMPANY, Auburn
PORTSMOUTH COMPUTER CENTER, Portsmouth
MARYLAND
COMM CENTER, Laurel
PROGRAM STORE, Baltimore
WILLS COMPUTER STORE, Marlow Heights
MASSACHUSETTS
COMPUTER CITY, Charlestown
HI FI EXCHANGE, Northampton
LAND OF ELECTRONICS, Lynn
MARK GORDON COMPUTERS, Cambridge
OMNITEK SYSTEMS, Tewksbury
SOUND COMPANY, Springfield
STAR COMPUTING, Framingham
THE GAME SHOP, East Acton
TUFTS RADIO ELECTRONICS, Medford
MICHIGAN
ALL FOR LEARNING, W. Bloomfield
ALTERNATE SOURCE, Lansing
A.M. ELECTRONICS, Ann Arbor
COMIC KINGDOM, Detroit
COMPUTER CENTER, Garden City
COMPUTER CONNECTION, Farmington Hills
COMPUTER MART, Clawson
COMPUTER MART, Flint
COMPUTERLAND, Kentwood
COMPUTERLAND, Southfield
COMPUTRONIX, Midland
EIGHT BIT CORNER, Muskegon
FERRIS RADIO, Hazel Park
HOBBY HOUSE, Battle Creek
LEARNING CENTER LTD., Ann Arbor
MAIN SYSTEMS, INC., Flint
MID-MICHIGAN MEMORY, Dimondale
NEWMAN COMPUTER EXCHANGE, Ann Arbor
TRI-COUNTY ELECTRONICS & SOUND CENTER, Fenton
WEATHERWAX DRUGS, Brooklyn
WIZARD'S ARSENAL, East Lansing
YE OLDE TEACHERS SHOPPE, Ypsilanti
MINNESOTA
CODE ROOM, Eden Prairie
MINNESOTA SOFTWARE, White Bear Lake
RURAL AMERICA ENTERPRISES, Marshall
ZIM COMPUTERS, Brooklyn Center
MISSISSIPPI
C-COM, Jackson
DYER'S INC., West Point
SOFTWAREHOUSE, Jackson
MISSOURI
CENTURY NEXT COMPUTERS, Columbia
COMPUTER CENTER, Joplin
COMP-U-TRS, Florissant
CRC COMPUTERS, Joplin
D'S, Cameron
HOUSE OF COMPUTERS, Joplin
SOFTWARE SHACK, Belton
MONTANA
COMPUTER STORE, Billings
THE COMPUTER PLACE, Kalispell
NEBRASKA
APPLETREE SOFTWARE, Battle Creek
COMPUTERS WEST, Omaha
GREAT RACE HOBBY PLACE, Lincoln
LEZOTTE STUDIO, Ogallala
NEVADA
CENTURY 23, Las Vegas
HURLEY ELECTRONICS, Las Vegas
NEW HAMPSHIRE
BITSNBYTES COMPUTER CENTER, Concord
COMPUCRAFT, Keene
COVER CRAFT, Amherst
PAUL'S TV, Fremont
PORTSMOUTH COMPUTER CENTER, Portsmouth
RADIO SHACK ASSOC. STORE, Keene
STURDIVANT AND DUNN, Conway
NEW JERSEY
ABC'S TV SALES & SERVICE, Glassboro
ADELMAN'S STATIONERY CO., Union City
BARGAIN BROTHERS, West Trenton
CHANNEL 1 RADIO SHACK, Medford
COMPUTER FORUM, Redbank
COMPUTER MADNESS, Englishtown
COMPUTERWORLD OF WESTFIELD, Westfield
CROWLEY'S, Whitehouse Station
DAVE'S ELECTRONICS, INC., Pennsville
ELECTRONIC WORLD, Mantua
HOBBYMASTERS, Red Bank
J&J ELECTRONIC WORLD, Mantua
LASHEN ELECTRONICS, INC., Denville
MIDAS DATA SYSTEMS INC., Marlton
OMNIFAX, Cherry Hill
RADIO SHACK ASSOC. STORE, Moorestown
RADIOS UNLIMITED, Somerset
SOFTWARE CITY, River Edge
NEW MEXICO
AUTEL ELECTRONICS CO., Albuquerque
J&W ENTERPRISES, Clovis
MITCHELL MUSIC, Carlsbad
THOMAS E. CARR JEWELER, Alamogordo
WARGAMES WEST, Albuquerque
NEW YORK
ARISTO CRAFT DISTINCTIVE MINIATURES, New York
ASD HOME COMPUTER CENTER, Poughkeepsie
BERLINER COMPUTER CENTER, New Hyde Park
C. HABILD OF NEW DORP, Staten Island
COMPUTER CORNER, White Plains
COMPUTER RESOURCES, Williamsville
COMPUTER SHOP, Kingston
COMPUTERLAND, Carle Place
COMPUTERLAND OF NYC, New York
DIGIBYTE SYSTEMS, New York
80-MICROCOMPUTER SERVICES, Cohoes
FUTURE VISIONS COMPUTER STORE, Melville
PHANTOS RESEARCH, Camillus
PROGRAMS UNLIMITED, Jericho
MR. COMPUTER, Wappingers Falls
OMNIFAX, DeWitt
SOFTRON SYSTEMS, Rensselaer
WATERLOO HOBBIES, Mineola
WORLD OF COMPUTERS, Port Chester
NORTH CAROLINA
RAYBURN MICRO-ELECTRONICS, Sylva
SOUND MILL, Havelock
OHIO
ABACUS II, Toledo
ALTAIR SYSTEMS, INC., Dayton
ASTRO VIDEO ELECTRONICS, INC., Lancaster
CINCINNATI COMPUTER STORE, Cincinnati
COMPUTER STORE, Toledo
COMPUTERLAND, Columbus
COMPUTERLAND, Mayfield Heights
COMPUTERLAND, North Olmsted
COMPUTERLAND, Warren
JOBAR ENTERPRISES, Middlefield
MICROAGE, Columbus
MICRO COMPUTER CENTER, Centerville
MICRO ELECTRONICS INC., Columbus
MICRO-MINI COMPUTER WORLD, Columbus
TWENTY-FIRST CENTURY SHOP, Cincinnati
WANNA PLAY, Cincinnati
OKLAHOMA
COMPUTER STORE, INC., Tulsa
COMPUTER WORLD, Tulsa
PROFILE INC., Moore
RADIO SHACK ASSOC. STORE, Guymon
SOUNDS, ETC., Watonga
OREGON
COMPUTER PATHWAYS, Salem
L&R ELECTRONICS, Grant Pass
PIONEER ELECTRONICS, Sandy
TRS-80 PRODUCTS LTD., Portland
PENNSYLVANIA
ALLIED HOBBIES, Philadelphia
ARTCO ELECTRONICS, Kingston
BELL ELECTRONICS, Girard
COMPUTERLAND, Gibsonia
COMPUTERLAND OF HARRISBURG, Mechanicsburg
ERIE COMPUTER, Erie
JNE COMMUNICATIONS, Altoona
MAFEX ASSOCIATES, Johnstown
OMNIFAX, Feasterville
OMNIFAX, Philadelphia
PERSONAL COMPUTER CORP., Paoli
PITTSBURG COMPUTER STORE, Pittsburg
STEVENS RADIO SHACK DEALER, Phoenixville
ROUTE 30 ELECTRONICS, Latrobe
RUMPELSTILSKIN TOY SHOP, New Hope
TELEVISION PARTS COMPANY INC., New Brighton
PUERTO RICO
MICRO COMPUTER STORE, Caparra Terrace
RHODE ISLAND
COLONIAL ENTERPRISES, Foster
SOUTH CAROLINA
OMNI ELECTRONICS, Charleston
TENNESSEE
ACE MINI SYSTEMS, Clarksville
CHATTANOOGA COMPUTER CENTER, Chattanooga
COMPUTER WORLD, Nashville
COMPUTERLAB, Memphis
TEXAS
CODEDATA INC., Arlington
COMPUSHOP, Bellaire
COMPUSHOP/FM 1960W, Houston
COMPUSHOP/N FWY, Houston
COMPUTER 'N THINGS, Austin
COMPUTER PROGRAMMING ASSOC., Lubbock
COMPUTER PORT, Arlington
COMPUTER SALES & SERVICE, Fort Worth
COMPUTER SOLUTIONS, San Antonio
COMPUTERLAND OF SW HOUSTON, Houston
COMPUTERS BY O'NEILL, Lake Jackson
COMPUTERS TO GO, Austin
COMPUTEX, Webster
CORSAIR, Ft. Worth
GATEWAY ELECTRONICS, Houston
KA ELECTRONICS, Dallas
MAC'S TV, Fairfield
MARYMAC INDUSTRIES (R/S DEALER), Houston
PAN AMERICAN ELECTRONICS (R/S DEALER), Mission
R.L. COLE'S ELECTRONICS, San Antonio
ROY'S CB & ELECTRONICS, Aransas Pass
80 SOFTWARE, San Antonio
WAGHALTER BOOKS, INC., Houston
UTAH
COMPUTERLAND, Salt Lake City
FOOTHILL MODELERS, Salt Lake City
VIRGINIA
COMPUTER SOLUTIONS, Leesburg
COMPUTER WORKS, INC., Harrisonburg
HOME COMPUTER CENTER INC., Virginia Beach
LITTLE SOLDIER, Alexandria
SYSTEMS MARKETING, Arlington
WASHINGTON
AMERICAN MERCANTILE COMPANY, Seattle
COMPUTERLAND, Bellevue
COMPUTERLAND, Federal Way
COMPUTERLAND, Spokane
EMPIRE ELECTRONICS, Sunnyside
J.B. SALES, Snohomoish
LORDS, Port Angeles
UNIVERSITY VILLAGE MUSIC, Seattle
U.S.S. ENTERPRISE, Kirkland
WESTERN MICROCOMPUTER CENTER, Bellingham
WEST VIRGINIA
COMPUTER CORNER, Morgantown
COMPUTER STORE, Huntington
OHIO VALLEY ELECTRONIC SYSTEMS, Wheeling
SOUND & ELECTRONIC SPECIALTIES, Morgantown
WISCONSIN
BYTE SHOP, Milwaukee
COMPUTERLAND, Madison
COMPUTERLAND OF FOX RIVER VALLEY, Oshkosh
COMPUTER WORLD, Green Bay
MAGIC LANTERN COMPUTER, Madison
OMEGA MICROS, Milwaukee
PETTED MICROSYSTEMS, Milwaukee
S&O TV SALES, Monroe
WYOMING
COMPUTER CONCEPTS, Cheyenne

AUSTRALIA
DE FOREST SOFTWARE, Nunawading, Vic.
CANADA

Distributor:
MICRON DISTRIBUTING,
Toronto, Ont.

ALLIED COMPUTER CENTRE, Thunder Bay, Ontario
ARKON ELECTRONICS, Toronto, Ontario
AULL COMPUTER SYSTEMS, Victoria, B.C.
BITS & BYTES, Dartmouth, N.S.
CENTRAL DISTRIBUTORS LTD., Lachine, Quebec
COMPUCORNER, Smithers, B.C.
COMPUMART, Ottawa, Ontario
COMPUTER BARN, Sarnia, Ontario
COMPUTER CIRCUIT, London, Ontario
COMPUTER INNOVATIONS, Ottawa, Ontario
COMPUTER SHOP LTD., Calgary, Alberta
COMPUTER WORLD, Vancouver, B.C.
COMPUTERLAND OF BURLINGTON, Burlington, Ontario
CREATIVE COMPUTERS, Victoria, B.C.
DATATEC COMPUTER SYSTEMS LTD., Saskatoon, Sask.
ELECTRONICS 2001, Willowdale, Ontario
GALACTICA COMPUTERS LTD., Edmonton, Alberta
IRISCO DU QUEBEC, Ste. Foy, Quebec
LYONS LOGIC LTD., London, Ontario
MICROMATION, Toronto, Ontario
MICROSHACK, Saskatoon, Sask.
MICRO SHACK, Regina, Sask.
M&W COMPUTERS, Mississauga, Ontario
NIP & TUCK VARIETY, London, Ontario
OFFICE CENTRE, Kingston, Ontario
SAULT OFFICE MACHINES, Sault St. Marie, Ontario
STATUS COMPUTER SYSTEMS, St. Catherines, Ontario
TOTAL COMPUTER SYSTEMS, Ajax, Ontario
WEST WORLD COMPUTERS, Edmonton, Alberta
ITALY
BITS & BYTES, Milan
NEW ZEALAND
VISCOUNT ELECTRONICS, Palmerston North
NORWAY
A/S SORLUND, Vedavagen
SWEDEN
SENTEC AB, Jarfalla
UNITED KINGDOM
CALISTO COMPUTERS, Birmingham
THE SOFTWARE HOUSE, London
WEST GERMANY
MICROSTUFF, Frankfurt
NETHERLANDS & BELGIUM

Distributor:
SOFTWARE IMPORT BRABANT,
Eindhoven, Neth.

COMPUTER COLLECTIEF, Amsterdam
MICRO COMPUTING, Krommenie
MICRO DYNAMICS, Eindhoven
MUSICPRINT-CHIP, Arkel
OVEL GONNE, Drachten
R.A.L. MICROCOMPUTERS, The Hague

YOUR NAME COULD BE HERE. CALL: 1-800-258-5473

Find out what you're missing.

You heard the lady. Your microcomputing life *is* going to be very exciting. But don't leave it to chance—leave it to us! We have a brand new catalog full of packages and valuable coupons to help make it happen. It's free . . . if you fill out the coupon and mail it today. (Or make a photocopy and spare your magazine).

NAME: ____________________

ADDRESS: ____________________

CITY: ____________________ STATE: ________ ZIP: ________

Instant Software™ Inc. Peterborough, N.H. 03458 603-924-7296 •A18

Here's an Applesoft utility that removes remark statements and thus frees up memory storage space and improves program execution speed without destroying program documentation.

Stamp Out REMs

By Paul Hitchcock

If you're a whiz at structured programming techniques and possess total recall as well, you probably don't need to use remark statements to help document your BASIC programs: everything is always logically ordered and details are never forgotten. On the ther hand, I usually use a great many of them, since I often can't remember where to find my Apple's on-off switch.

But for all their usefulness in program documentation, REM statements have two not-so-useful characteristics: they consume memory and they reduce program execution speed.

One obvious solution to these problems is to file fully-documented back-up copies of your programs, but have versions without REM statements on hand for everyday use. However, should you become hazy about the inner workings of a program and find that you've misplaced your back-up, you can spend literally hours of painful drudgery stepping through a long program in search of lost knowledge.

Another more reliable solution is to use the REM-mover program given in Listing 1. With this short machine-language program, you can quickly eliminate REM statements from a previously loaded Applesoft program using only a single keyboard-issued command. You thus gain all of the speed and space advantages of programs without REM statements, but your on-line programs can be identical to your back-up copies; should you lose either one, you do not lose the essential documentation.

Name	Address	Function
INIT	300–308	Initialize next statement pointer to 801
EOP	309–320	Check for end of program; get next address
REMCH	321–328	Check for REM statement
NOREM	329–333	Get next statement; jump to EOP
REM	334–33A	Save address in stack
	33B–340	Calculate offset
SHIFT	341–35E	Shift BASIC program to cover REM statement
SETPT	35F–372	Set Applesoft pointers
ADJST	379–3BB	Adjust next-statement pointer bytes; get next address; jump to EOP

REM-mover uses five zero page memory locations: 06 through 09 and 19. Registers 06 and 07 hold the address of the BASIC program statement that REM-mover is currently examining; registers 08 and 09 contain the address of the next statement. Register 19 holds the "offset number," as was mentioned in the text of the article.

Table 1. REM-mover routines.

Entering and Using REM-Mover

The REM-mover program will work only with Applesoft in ROM; it will *not* work with cassette Applesoft, diskette Applesoft or Integer BASIC. REM-mover's single limitation is that it can remove only those REM statements which begin with statement numbers; it will not remove a REM which comes at the end of another program statement.

You may enter the program as shown in Listing 1 using the Apple's mini-assembler, but it would probably be easier to use the hex dump in Listing 2. Enter the monitor with CALL-151 and type in each line as shown, remembering to change the dash after each address to a colon. When you have finished, carefully check your work. Since REM-mover

Address correspondence to Paul Hitchcock, 2309 Blake St., #308, Berkeley, CA 94704.

←Reader Service for facing page ✓405

accesses several of Applesoft's more sensitive areas, a typing error when entering the program could cause your Apple to hang when you first attempt to use REM-mover. To resume normal operation, you would then have to turn your computer off, then on again, thereby erasing any program you had in memory.

To save the program on cassette, use the monitor command "300. 3BBW (return)", making sure that your recorder is running before pressing the return key. You can save REM-mover on disk with the DOS command "BSAVE REM-MOVER, A$300, L$BB (return)".

Using REM-mover is simple: Load an Applesoft program that contains REM statements and remove the REMs by typing

(from BASIC)	CALL 768	(return)
(from the monitor)	300G	(return)

When you list your program, you'll find that all of the REM statements have vanished, leaving you with a shorter and faster-running program. Listing 3 demonstrates REM removal and also shows how REMs can adversely affect program speed.

One word of caution: If your program contains any GOTO or GOSUB statements which reference REM statements, you must change the branching addresses to ensure error-free program operation after you have removed the REMs.

How REM-Mover Works

Understanding how REM-mover works requires an elementary knowledge of the way in which the Apple actually stores a BASIC program. Individual statements are not stored in the computer as they appear in a program listing; instead, each statement is coded into a form which is more usable from the standpoint of the BASIC interpreter.

One of the more important aspects of this coding is the assignment of a "token" to each BASIC keyword. That is, every keyword is given a number, called a token, and it is this number, rather than a string representation of the keyword, which is used by the interpreter. Using tokens for keywords such as RUN and REM not only saves memory, but also speeds up the interpreting process. The coding process is referred to, appropriately enough, as "tokenizing."

When you type in a program statement and press the return key, Applesoft tokenizes the statement and inserts it into memory immediately following the statement with the next lowest statement number. Program storage for ROM Applesoft begins at the address 801 (hexadecimal).

To illustrate the tokenizing process, consider the following useless (but instructive) program:

```
10 REM
20 END
```

The tokenized version of this program is

```
801-07 08 0A 00 B2 00 OD
808-08 14 00 80 00 00 00
```

The bytes 801 through 806 are the machine representation of the first statement of the program, 10 REM. The first two bytes, 801 and 802, contain the starting address of the next statement: 807. (Note that the low byte precedes the high byte of the address.) The next two bytes, 803 and 804, hold the statement number 00 0A, or 10 in decimal. The fifth byte, 805, contains the number B2, which is the token for the keyword REM. Finally, the sixth and last byte of the statement, 806, contains 00, which denotes the end of the statement.

The next statement, 20 END, may be broken down into its constituent parts in exactly the same way. Notice, though, that the first two bytes of the second statement (807 and 808) seem to imply there is another statement which begins at 80D. This is clearly impossible, since the program consists of only two statements, not three. However, if you examine the first two bytes of this phantom statement, 80D and 80E, you will see that they both contain 00, instead of another set of next-statement pointers. This is how Applesoft signifies the end of a program: whenever the next-statement pointer bytes contain zeroes, the interpreter stops. . . well, stops interpreting.

Armed with the above information, you can now see how REM-mover works. Beginning at 801, REM-mover first tests this address and the next to see if they both contain zero; if they do, REM-mover stops. Should the zero test fail, REM-mover then checks the fifth byte of the statement for the number B2, to see if the statement is a REM statement. If B2 is *not* found, REM-mover proceeds to the next statement, whose address is found in the first two bytes of the statement currently being examined. This procedure continues until either a REM statement is found or the end of the program is reached.

If REM-mover does encounter a REM statement, the next step it takes is to calculate an offset number, which is equal to the difference between the address of the next statement and the address of the REM itself. The offset is not used immediately, but is stored temporarily in the zero page location 19. Next, REM-mover shifts down to the address of the REM all of the remaining bytes of the program statements which follow

```
*300LLLLLL

0300-   D8          CLD
0301-   A9 01       LDA   #$01
0303-   A0 08       LDY   #$08
0305-   85 06       STA   $06
0307-   84 07       STY   $07
0309-   A2 00       LDX   #$00
030B-   A0 00       LDY   #$00
030D-   B1 06       LDA   ($06),Y
030F-   85 08       STA   $08
0311-   D0 01       BNE   $0314
0313-   E8          INX
0314-   C8          INY
0315-   B1 06       LDA   ($06),Y
0317-   85 09       STA   $09
0319-   D0 01       BNE   $031C
031B-   E8          INX
031C-   E0 02       CPX   #$02
031E-   D0 01       BNE   $0321
0320-   60          RTS
0321-   A0 04       LDY   #$04
0323-   B1 06       LDA   ($06),Y
0325-   C9 B2       CMP   #$B2
0327-   F0 0B       BEQ   $0334
0329-   A5 08       LDA   $08
032B-   A4 09       LDY   $09
032D-   85 06       STA   $06
032F-   84 07       STY   $07
0331-   4C 09 03    JMP   $0309
0334-   A5 07       LDA   $07
0336-   48          PHA
0337-   A5 06       LDA   $06
0339-   48          PHA
033A-   38          SEC
033B-   A5 08       LDA   $08
033D-   E5 06       SBC   $06
033F-   85 19       STA   $19
0341-   A0 00       LDY   #$00
0343-   B1 08       LDA   ($08),Y
0345-   91 06       STA   ($06),Y
0347-   E6 06       INC   $06
0349-   D0 02       BNE   $034D
034B-   E6 07       INC   $07
034D-   E6 08       INC   $08
034F-   D0 02       BNE   $0353
0351-   E6 09       INC   $09
0353-   A5 08       LDA   $08
0355-   C5 AF       CMP   $AF
0357-   D0 EA       BNE   $0343
0359-   A5 B0       LDA   $B0
035B-   C5 09       CMP   $09
035D-   D0 E4       BNE   $0343
035F-   A5 06       LDA   $06
0361-   85 AF       STA   $AF
0363-   85 69       STA   $69
0365-   85 6B       STA   $6B
0367-   85 6D       STA   $6D
0369-   A5 07       LDA   $07
036B-   85 B0       STA   $B0
036D-   85 6A       STA   $6A
036F-   85 6C       STA   $6C
0371-   85 6E       STA   $6E
0373-   68          PLA
0374-   85 06       STA   $06
0376-   A8          TAY
0377-   68          PLA
0378-   85 07       STA   $07
037A-   48          PHA
037B-   98          TYA
037C-   48          PHA
037D-   A2 00       LDX   #$00
037F-   A0 00       LDY   #$00
0381-   B1 06       LDA   ($06),Y
0383-   85 08       STA   $08
0385-   D0 01       BNE   $0388
0387-   E8          INX
0388-   C8          INY
0389-   B1 06       LDA   ($06),Y
038B-   85 09       STA   $09
038D-   D0 01       BNE   $0390
038F-   E8          INX
0390-   E0 02       CPX   #$02
0392-   D0 09       BNE   $039D
0394-   68          PLA
0395-   85 06       STA   $06
0397-   68          PLA
0398-   85 07       STA   $07
039A-   4C 09 03    JMP   $0309
039D-   A0 00       LDY   #$00
039F-   38          SEC
03A0-   A5 08       LDA   $08
03A2-   E5 19       SBC   $19
03A4-   85 08       STA   $08
03A6-   91 06       STA   ($06),Y
03A8-   B0 07       BCS   $03B1
03AA-   C8          INY
03AB-   C6 09       DEC   $09
03AD-   A5 09       LDA   $09
03AF-   91 06       STA   ($06),Y
03B1-   A5 08       LDA   $08
03B3-   A4 09       LDY   $09
03B5-   85 06       STA   $06
03B7-   84 07       STY   $07
03B9-   4C 7D 03    JMP   $037D
03BC-   00          BRK
```

Listing 1. REM-mover machine-language program.

the REM, thereby covering up the REM.

After the shift operation, the BASIC program's length is decreased by an amount equal to the offset mentioned above. To compensate for this decrease in program length, REM-mover subtracts the offset from several important Applesoft pointers, then stores the results back into the proper locations. These pointers are

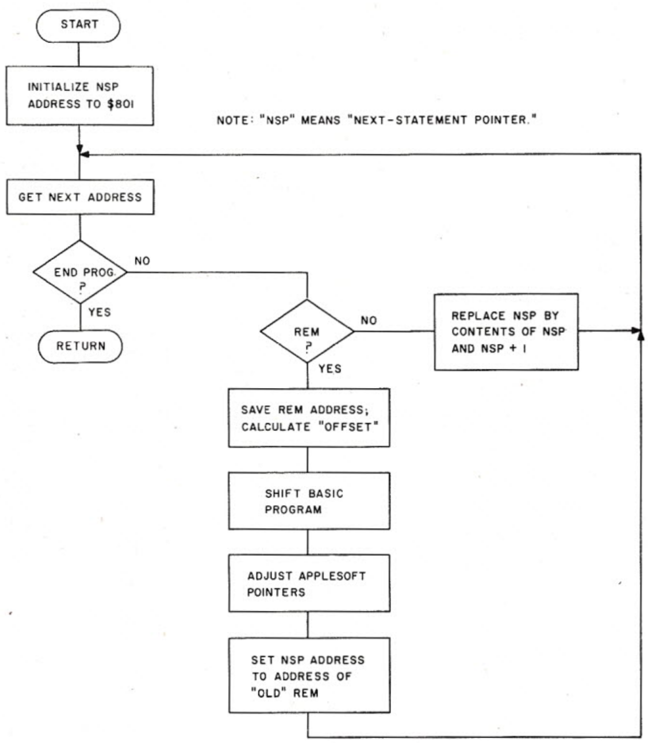


Fig. 1. REM-mover flowchart.

```
]CALL-151

*300.3BC

0300- D8 A9 01 A0 08 85 06 84
0308- 07 A2 00 A0 00 B1 06 85
0310- 08 D0 01 E8 C8 B1 06 85
0318- 09 D0 01 E8 E0 02 D0 01
0320- 60 A0 04 B1 06 C9 B2 F0
0328- 0B A5 08 A4 09 85 06 84
0330- 07 4C 09 03 A5 07 48 A5
0338- 06 48 38 A5 08 E5 06 85
0340- 19 A0 00 B1 08 91 06 E6
0348- 06 D0 02 E6 07 E6 08 D0
0350- 02 E6 09 A5 08 C5 AF D0
0358- EA A5 B0 C5 09 D0 E4 A5
0360- 06 85 AF 85 69 85 6B 85
0368- 6D A5 07 85 B0 85 6A 85
0370- 6C 85 6E 68 85 06 A8 68
0378- 85 07 48 98 48 A2 00 A0
0380- 00 B1 06 85 08 D0 01 E8
0388- C8 B1 06 85 09 D0 01 E8
0390- E0 02 D0 09 68 85 06 68
0398- 85 07 4C 09 03 A0 00 38
03A0- A5 08 E5 19 85 08 91 06
03A8- B0 07 C8 C6 09 A5 09 91
03B0- 06 A5 08 A4 09 85 06 84
03B8- 07 4C 7D 03 00
*
```

Listing 2. REM-mover hex dump.

contained in the addresses 69 through 6E and in AF and B0. Rather than go into a detailed explanation of the functions of these pointers, let me refer you to the appendix in the *Applesoft II Reference Manual* entitled "Zero Page Memory Map."

Next, the same offset is used again to adjust the next-statement pointer bytes for all of the shifted statements. REM-mover returns to the address of the first byte of the now-removed REM statement; this address is now the address of the statement which originally followed the REM. The offset is then subtracted from these two bytes and the result is deposited back into the addresses. Using this new pointer address, REM-mover goes to the next statement, subtracts the offset and repeats this procedure until it reaches the end of the program.

Finally, the REM-mover returns to the address of the removed REM statement and starts anew the search for the next REM. When all of the REM statements have been removed, the machine-language program returns control of the computer back to you. REM-mover is quite fast; it will delete 1000 bytes of REM statements in less than 18 seconds.

Because the algorithm for removing REMs can be confusing, I have included Fig. 1 and Table 1. Fig. 1 is a simplified flowchart of the REM-mover program and Table 1 lists the addresses and functions of REM-mover's important routines.■

```
]LIST

10  REM ....REM STATEMENTS
20  REM ....CONSUME SPACE.
30  REM
40  FOR I = 1 TO 1000
50  REM
60  REM ....AND IN LOOPS,
70  REM ....REM STATEMENTS
80  REM ....CONSUME TIME!
90  REM
100  NEXT

]CALL 768

]LIST

40  FOR I = 1 TO 1000
100  NEXT
```

```
]LIST

10  REM ....REM STATEMENTS
20  REM ....CONSUME SPACE.
30  REM
40  FOR I = 1 TO 1000
50  REM
60  REM ....AND IN LOOPS,
70  REM ....REM STATEMENTS
80  REM ....WASTE TIME!
90  REM
100  NEXT

]CALL 768

]LIST

40  FOR I = 1 TO 1000
100  NEXT
```

Listing 3. REM statements can drastically increase program execution time. The program containing REM statements took 3.5 seconds to complete a RUN, while the version without REM statements required only 1.2 seconds.

See List of Advertisers on page 210

This month, Microcomputing's *68xx expert reviews a "dynamite" program, and builds a 48K 6809 system.*

68xx Secrets

By Peter A. Stark

When asked to review Dynamite—a 6809 disassembler program—I jumped at the chance. The first step, of course, was to get my system to the point where switching back and forth between the 6800 and 6809 processor boards would be easy. Little did I know what that would lead to!

The review of Dynamite turned out to be the last thing done, but I'll cover that first.

Dynamite is a superb disassembler program being marketed by the Computer Systems Center (13461 Olive Blvd., Chesterfield, MO 63017). Although it runs on a 6809 and requires the FLEX 9 disk operating system and a minimun of 24K bytes of programmable random-access memory (RAM), it can disassemble both 6800 and 6809 code.

Using the word superb to describe it is not an exaggeration. In quite a bit of use, it has proven to be invaluable and, despite much effort, I can think of little I'd change on it if I had my way.

Essentially, a disassembler is a program which takes a machine-language program and translates it into assembly language. Several other 68xx disassemblers are available, dating all the way back to the SWTP Desembler, and a Motorola disassembler before that. Dynamite is thus not the first, but it definitely has some features that put it in a class of its own.

Unlike earlier disassemblers that work on a machine-language program in memory, Dynamite takes machine code from a disk file. This has several advantages. It's not necessary to load the program first, and worry about whether it will conflict with the disassembler itself. A more visible advantage is that you don't have to even know the starting and ending addresses of the program being disassembled. Even if it is split up into several segments which lie in different places, Dynamite will insert the appropriate ORG statements into the assembly code, and will not disassemble locations that are not part of the program.

(It is possible to disassemble just part of a disk file. This is useful if you need to work on a certain segment of a program—I/O, for example, or when the program is too large for the assembly listing to fit on one disk.)

Dynamite can produce a printed disassembled listing (which includes both the machine code as well as the assembly-language code in the same format as would be produced by an assembler), or it can write just the assembly-language code to another disk file. This code is in the right format so it can immediately be reassembled. I tried it out on several long system programs, to see whether, if I disassembled with Dynamite and then reassembled its output, I would get the same machine-language program. In each case, that's exactly what I got. It's obviously not very useful, but it is a good test to make sure Dynamite works.

The foregoing are simply the basics that any good disassembler should do. But Dynamite has some additional features.

First, a typical machine-language program does not contain only instructions. Buried among the instructions may be ASCII text, data or address pointers. Since no disassembler can be intelligent enough to find these by itself, there must be some way of manually identifying and specifying them.

If you have a printed program listing of what you're disassembling, then it's a simple (though perhaps lengthy) matter to go through it and identify each portion. Lacking that, Dynamite can help. By invoking an optional ASCII printout (in which Dynamite converts all printable codes into their ASCII characters and prints them), it is easy to find text strings in the code. Since Dynamite converts all unrecognizable instructions into FCB statements automatically, this is a good beginning. By letting Dynamite go through the machine-language program several times, displaying the result on the terminal, you can visually identify most data and text areas and separate them from pure code.

Once program and data areas are identified, you must tell Dynamite what they are. This information can be entered directly from the keyboard, or can be stored in a command file. Direct keyboard entry is more convenient and faster, but really only useful for short programs. When disassembling long programs, it is far more convenient to store this information as a separate command file, which is read by Dynamite during

Address correspondence to Peter A. Stark, PO Box 209, Mt. Kisco, NY 10549.

disassembly. This latter approach is especially convenient when making multiple passes through a strange program. As each pass uncovers more data and text areas, you simply add them to the command file without retyping information already there.

Dynamite command files are text files that look like this:

```
A 2010-2022
B 2044-2046
L 2100-2101
W 2200-2213
```

The letters identify the type of data—A for ASCII, B for byte, L for label and W for two-byte (word) data—and are followed by the address range. For example, the above example specifies that locations 2010 through 2022 contain ASCII text.

A typical calling sequence to start Dynamite looks like

```
+++DYNAMITE INFILE OUTFILE
+OPTIONS +COMMAND—FILE
```

which contains the disk file names of the machine-language code input file, as well as the assembly-language output file, if any, a list of options, and the name of the command text file.

Possible options include printing of ASCII codes, prompting for commands from the keyboard, writing to the disk or a printer, generating line numbers or paginating, disassembling just a segment of a program, disassembling 6800 or 6809 code and using alternate disk drives.

An even more interesting aspect of Dynamite is how it handles the generation of labels. Whenever disassembling a machine-language program into assembly language, you must insert labels into the resulting assembly code. Dynamite does this by generating dummy labels which consist of the letter L followed by the address of that label in the original program; for example, LE1D1 would be the label assigned to location E1D1 hexadecimal. This makes it easy to find these labels in an assembly listing.

But many locations already have standardized labels. For example, most 6800 users will recognize E1D1 as being the address of OUTEEE in the monitor. Dynamite is smart enough to know that too!

In addition to reading a command file from disk, Dynamite can also read label files. A label file is a file that tells Dynamite what labels to assign to specific locations.

Dynamite is supplied with five label files: DISLBL00, DISLBL09, SBUGLBL, SWTBGLBL and MFLEXLBL. These contain, respectively, the labels for 6800 FLEX, 6809 FLEX, SBUG, SWTBUG and 6800 MiniFLEX. (FLEX, UNIFLEX and MiniFLEX are registered trademarks of Technical Systems Consultants, and SBUG and SWTBUG are registered trademarks of Southwest Technical Products Corp.) These label files are remarkably complete, and even include some data not commonly known.

```
B 0050-01FF   A 027D-027E   L 02EA-02EB   B 034A-034A
A 0214-021A   L 027F-0280   A 02EC-02F3   A 034B-0354
L 021B-021C   A 0281-0287   L 02F4-02F5   A 044C-044D
A 021D-021E   L 0288-0289   A 02F6-02F7   A 0458-045E
L 021F-0220   A 028A-028B   L 02F8-02F9   A 0464-0470
A 0221-0227   L 028C-028D   A 02FA-02FE   A 0476-0482
L 0228-0229   A 028E-0291   L 02FF-0300   A 0946-0948
A 022A-022B   L 0292-0293   A 0301-0304   L 0949-094A
L 022C-022D   A 0294-0298   L 0305-0306   A 094B-094E
A 022E-0234   L 0299-029A   A 0307-030B   L 094F-0950
L 0235-0236   A 029B-029D   L 030C-030D   B 0951-0952
A 0237-023B   L 029E-029F   A 030E-030F   L 0953-0954
L 023C-023D   A 02A0-02A4   L 0310-0311   B 0955-0955
A 023E-0240   L 02A5-02A6   A 0312-0315   A 0982-0988
L 0241-0242   A 02A7-02AE   L 0316-0317   A 0A31-0A47
A 0243-0244   L 02AF-02B0   A 0318-031B   A 0BF2-0C07
L 0245-0246   A 02B1-02B3   L 031C-031D   A 0C77-0C86
A 0247-024D   L 02B4-02B5   A 031E-031F   A 0D7F-0DCA
L 024E-024F   A 02B6-02B7   L 0320-0321   A 0FCA-0FD3
A 0250-0251   L 02B8-02B9   A 0322-0328   A 10B4-10CF
L 0252-0253   A 02BA-02C1   L 0329-032A   A 1241-1244
A 0254-025A   L 02C2-02C3   A 032B-032C   L 1245-1246
L 025B-025C   A 02C4-02C5   L 032D-032E   A 1247-124B
A 025D-0260   L 02C6-02C7   A 032F-0334   L 124C-124D
L 0261-0262   A 02C8-02CD   L 0335-0336   A 124E-1251
A 0263-0267   L 02CE-02CF   A 0337-0338   L 1252-1253
L 0268-0269   A 02D0-02D1   L 0339-033A   A 1254-1258
A 026A-026B   L 02D2-02D3   A 033B-033C   L 1259-125A
L 026C-026D   A 02D4-02D8   L 033D-033E   B 125B-125B
A 026E-0271   L 02D9-02DA   A 033F-0343   A 1511-1525
L 0272-0273   A 02DB-02E3   L 0344-0345   A 17EF-1859
A 0274-027A   L 02E4-02E5   A 0346-0347   B 185A-19DA
L 027B-027C   A 02E6-02E9   L 0348-0349
```

Listing 1. Dynamite command file for disassembling the MiniFlex editor.

Using these label files, Dynamite produces a very readable assembly listing. But there is more—it is easy to write your own label file, which can then either be appended to one of the predefined label files, or can be used in addition to it. Thus it is possible to produce an assembly-language file which is full of meaningful labels, and do it fairly simply. With other disassemblers, this can only be achieved by fairly lengthy editing of the resulting assembly code.

My only complaint about Dynamite has to do with its label files. To make it easy for Dynamite to read the file, label files are written as assembly-language files and then assembled. For example, a typical label file might begin as

```
FCC 'INEEE'
FDB $E1AC
FCC 'OUTEEE'
FDB $E1D1
```

and would then have to be assembled into a .BIN file before Dynamite can use it. It would be nice if Dynamite could use the text file as is without the extra assembly. But that is just a minor inconvenience. Other than that, Dynamite is superb.

Dynamite Example

Because Dynamite can disassemble 6800 as well as 6809 code, it seemed useful to try it out on a real practical job—converting the MiniFLEX version of TSC's text editor to run under FLEX 9 on a 6809. The decision to convert a MiniFLEX editor to FLEX 9, rather than starting with a FLEX 2 editor, was made since it seemed to be more of a test of Dynamite. It worked out well, but in the process I discovered that it really wasn't so easy and practical after all. Though Dynamite did a great job disassembling the editor, an editor was needed to edit the resulting assembly code before it could be reassembled

for the 6809. And if you already have a 6809 editor, then there isn't much need to convert one from the 6800.

Nevertheless, the procedure for doing a typical conversion goes like this:

Since Dynamite runs on a 6809, the first step is to get the program to be converted onto a disk that Dynamite can read on the 6809. There are several ways to do this. One is to load it into memory on a 6800 system, dump it out to cassette, read that cassette into a 6809 system and save it on tape. If the 6800 and 6809 systems are near each other, their RS-232C ports can be connected, and the cassette commands used to transfer from one to the other. A third way is to transfer the program from a MiniFLEX disk to a FLEX 2 disk on the 6800, resulting in a disk that can be read on the 6809. Finally, it is possible to write a utility for reading MiniFLEX disks on a 6809.

Once the program is on a 6809 disk, it is time to do a few disassemblies and identify data areas. Listing 1 is the resulting command table I came up with for the MiniFLEX editor. Normally, an editor would be used to prepare this file, though it is possible to use the BUILD utility if you type well enough.

The next step is to use Dynamite to disassemble the code, resulting in an assembly-language file on a 6809 FLEX 9 disk. This file must now be edited so it can be reassembled into the correct code.

When converting the editor itself, this turns out to be a problem that has both obvious and not-so-obvious solutions. (A year ago, when I predicted that converting to a 6809 would cost a lot of money for software, one irate reader complained about my negative attitude, and insisted that he had no problem converting all of his disk software from a 6800 to a 6809. Wonder how he solved this one!)

The editing involved several items. First, all DOS references had to be changed to their new addresses. (See Listing 2 for a cross-reference list of commonly-used locations in various DOS implementations.)

For the benefit of anyone trying to repeat this particular conversion, several references to the 6800 monitor also had to be changed. This involved changing an A048 hexadecimal to CC16, E1D1 to CD0F, and E1AC to CD09. Another change involved changing a BEQ instruction to LBEQ (in line 2682 if you use the same command file). Since the 6809 code is slightly longer, the branch in the 6809 code was too long for the standard BEQ instruction. Another change involved changing a line which read CPX #LINBUF to read CPX #$C000, so as to avoid potential problems with the machine stack.

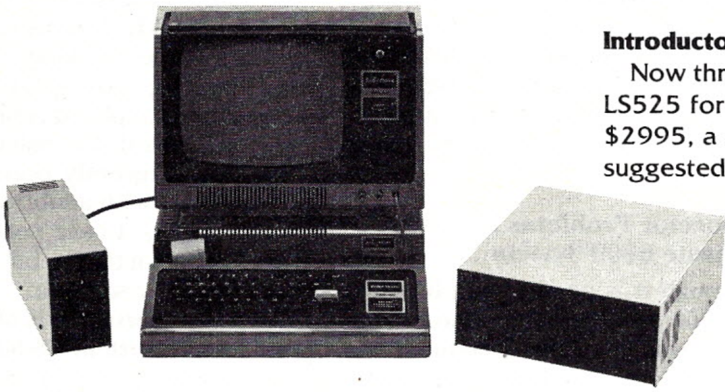
The last change required lengthening the read and write FCB buffers from the 192 bytes used in MiniFLEX to the 320 bytes used in FLEX 9. In my case, the obvious places were to

LINBUF	7000	A080	C080
TTYBS	7080	AC00	CC00
TTYDEL	7081	AC01	CC01
TTYEOL	7082	AC02	CC02
TTYDP	7083	AC03	CC03
TTYWD	7084	AC04	CC04
TTYNL	7085	AC05	CC05
TTYTB	7086	AC06	CC06
TTYBE		AC07	CC07
TTYEJ	7088	AC08	CC08
TTYPS	7089	AC09	CC09
TTYESC	708A	AC0A	CC0A
SYSDRV	708B	AC0B	CC0B
WRKDRV	708C	AC0C	CC0C
SYSMTH		AC0E	CC0E
SYSDAY		AC0F	CC0F
SYSYR		AC10	CC10
LSTTRM	7091	AC11	CC11
UCMDTB	7092	AC12	CC12
LINPTR	7094	AC14	CC14
ESCRET	7096	AC16	CC16
CURCHR		AC18	CC18
PRVCHR	709A	AC19	CC19
CURLIN	709B	AC1A	CC1A
LDROFF	709C	AC1B	CC1B
XFERFG	709E	AC1D	CC1D
XFERAD	709F	AC1E	CC1E
ERRTYP	70A2	AC20	CC20
SPECIO		AC21	CC21
OUTSW	70A3	AC22	CC22
INSW		AC23	CC23
OUTFIL		AC24	CC24
INFIL		AC26	CC26
CMDFLG	70A5	AC28	CC28
CURCLM	70A6	AC29	CC29
MEMEND		AC2B	CC2B
ERRVEC		AC2D	CC2D
FILEKO		AC2F	CC2F
CPUTYP		AC33	CC33
PRTADR		AC35	CC35
PRTLNG		AC37	CC37
PRTDVC		AC39	CC39
PINIT		ACC0	CCC0
PCHK		ACD8	CCD8
POUT		ACE4	CCE4
COLDS	7100	AD00	CD00
WARMS	7103	AD03	CD03
RENTER	7106	AD06	CD06
INCH	7109	AD09	CD09
INCH2		AD0C	CD0C
OUTCH	710C	AD0F	CD0F
OUTCH2	7136	AD12	CD12
GETCHR	710F	AD15	CD15
PUTCHR	7112	AD18	CD18
INBUFF	7115	AD1B	CD1B
PSTRNG	7118	AD1E	CD1E
CLASS	711B	AD21	CD21
PCRLF	711E	AD24	CD24
NXTCH	7121	AD27	CD27
RSTRIO	7124	AD2A	CD2A
GETFIL	7127	AD2D	CD2D
LOAD	712A	AD30	CD30
SETEXT	712D	AD33	CD33
ADDBX	7130	AD36	CD36
OUTDEC	7133	AD39	CD39
OUTHEX	7139	AD3C	CD3C
RPTERR	713C	AD3F	CD3F
GETHEX	713F	AD42	CD42
OUTADR		AD45	CD45
INDEC		AD48	CD48
DOCMND	7142	AD4B	CD4B
STAT		AD4E	CD4E
SYSFCB	7740	A840	C840
FMSINT	7800	B400	D400
FMSCLS	7803	B403	D403
FMS	7806	B406	D406
BASFCB	7809	B409	D409
CURFCB	780B	B40B	D40B
VRFYFG	782D	B435	D435
TTYDPX	7087		
ACIAFG	70A1		

Listing 2. DOS addresses for MiniFlex, Flex 2.0 and Flex 9.

THE NEW LAREDO LS525. WHEN YOU'RE READY TO GET DOWN TO BUSINESS.

Laredo Systems, Inc. introduces the LS525 five megabyte rigid disk memory system for TRS80 Models I and III. Laredo's LS525 rounds up a Seagate ST506 Drive, LDOS Operating System by Logical Systems, and Laredo's own LSI



500 Series Controller into a single-board controller that emulates the famed IBM 3370 disk system, complete with:

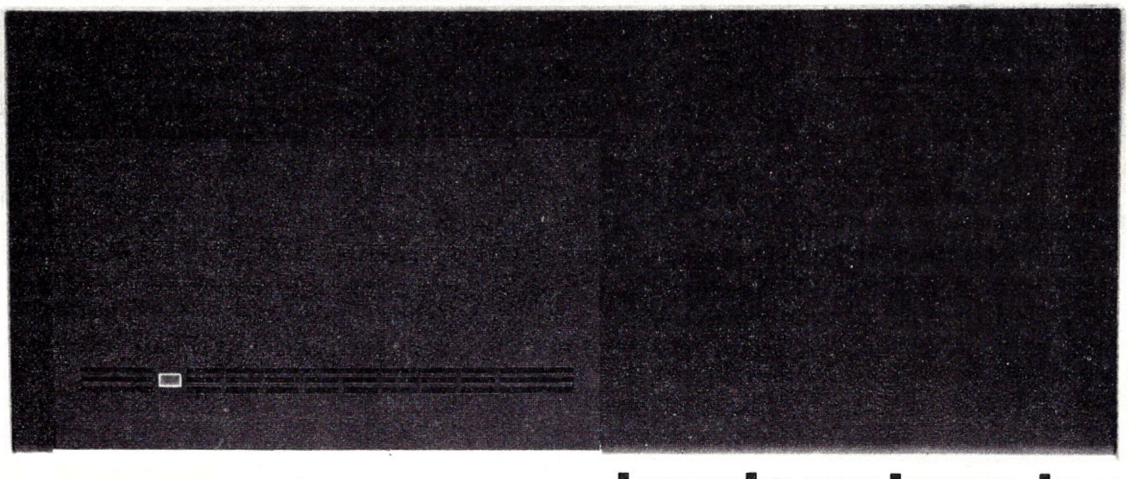
• Improved read/write/seek access time through full block buffering and variably tuned interleave.
• On-board data separator, micro-code diagnostics and write-precompensation.
• Increased disk media reliability and data integrity with automatic defect block allocation and extended ID fields.
• Versatile CPU compatibility provided by separate host adaptor.

Introductory Offer To TRS-80 Users.

Now through February 1, 1982 buy the LS525 for the OEM/dealer price of $2995, a savings of $755 off the usual suggested retail price of $3750.

LDOS Operating System with manual and diskette available for $149.

For more information about the LS525 Memory System and the LSI 500 Series Controller, contact: **Laredo Systems, Inc.**
2264 Calle de Luna,
Santa Clara, CA 95050
(408) 988-0315



laredo systems inc.

394

See List of Advertisers on page 210

add an RMB 128 just before labels L191A and again just before the $0D that is just above L19DB. A not so obvious change (which took a while to find) was to change a STA 192,X instruction to STA 320,X in the middle of the program.

And then it worked!

Disassembling an editor and then converting it to run on the 6809 is not really practical, but is at least feasible. But other jobs are not so feasible. For example, it would be very difficult to convert the 6800 assembler to run on the 6809 and produce 6809 code. Likewise, converting 6800 FLEX into 6809 FLEX, or converting TSC 6800 BASIC to the 6809 would be well-nigh impossible.

In other words, Dynamite is not the solution to the high software cost of upgrading from a 6800 to a 6809. But it is a good starting point, especially these days when so few software vendors provide the source code for their products.

Connector Problems Lead to a Separate 6809 System

Though it is possible to plug both the 6800 and the 6809 microprocessor boards into the system at the same time and switch them in and out by adding some logic circuitry, I decided to switch back and forth between the two processors by plugging and unplugging the boards. Everything worked just fine for a while, but soon I found my system becoming very unreliable. Sometimes it would work with one board and not the other; other times it wouldn't work with either.

After many hours of troubleshooting—and some lost data and programs—I narrowed it down to a connector problem. There was quite a bit of corrosion on the motherboard connectors and the system board connectors. With the continued plugging and unplugging of boards, this corrosion was being loosened, and was finding its way between contacts. I had been warned about this problem by Harold Mauch, the president of Percom Data Company, over two years ago, but never really expected to get it. What to do?

Mauch's solution was to clean the contacts with a Pink Pearl eraser at periodic intervals. While this worked, others suggested that perhaps isopropyl alcohol on a piece of cloth was safer. I ultimately went to the alcohol, with a cloth used on the male contacts of the motherboard, and a pipe cleaner used on the female contacts of the plug-in boards. I have also tried a freon aerosol spray; while this seems to work just as well, it is much more expensive. (I spoke with the representatives of the connector manufacturer at a recent trade show, but they weren't able to offer any suggestions.)

Some manufacturers try to avoid the problem by using gold-plated connectors rather than the tin-plate used by SWTP. While this is undoubtedly the better way, it is expensive (the additional cost of gold connectors over tin adds at least $100 to $200 to the cost of an entire system). Moreover, if boards will be plugged and unplugged often, then the very thin gold coating is likely to be worn off quite quickly. It is also not a good idea to mix the two kinds of connectors—having gold-plated cards plugged into tin-plated connectors on the motherboard, for instance.

SWTP has recently been shipping their systems with a lubricant on the connector pins. I have not been able to find out what that is, but am on the trail of another solution.

Connector corrosion is obviously a problem not just in SS-50 systems. For example, Motorola has run into that problem on their commercial two-way radios, and has just introduced a service kit consisting of a contact cleaner and lubricant for cleaning their tin-plated connectors. I have one on order, and will try it out. (Readers in the two-way radio business may want to read Motorola Service and Repair Note 908; their part numbers are 11-82346D01 for the freon cleaner and 11-80344A80 for the lubricant.

The problem with all of these *solutions*, of course, is that trying the wrong chemical may make the problem much worse.

Since connector problems are greatly worsened by plugging and unplugging boards, I decided that this had to be avoided. While I could have set up a switching scheme so both boards could stay plugged in together, this conflicted with some other plans, and so I decided to simply put some of my extra boards to use by building a separate 6809 system.

Rack-Mounting an S-50 System

While a simple system can easily occupy the top of a table or workbench, a more complex system can take up a lot of room. I therefore de-

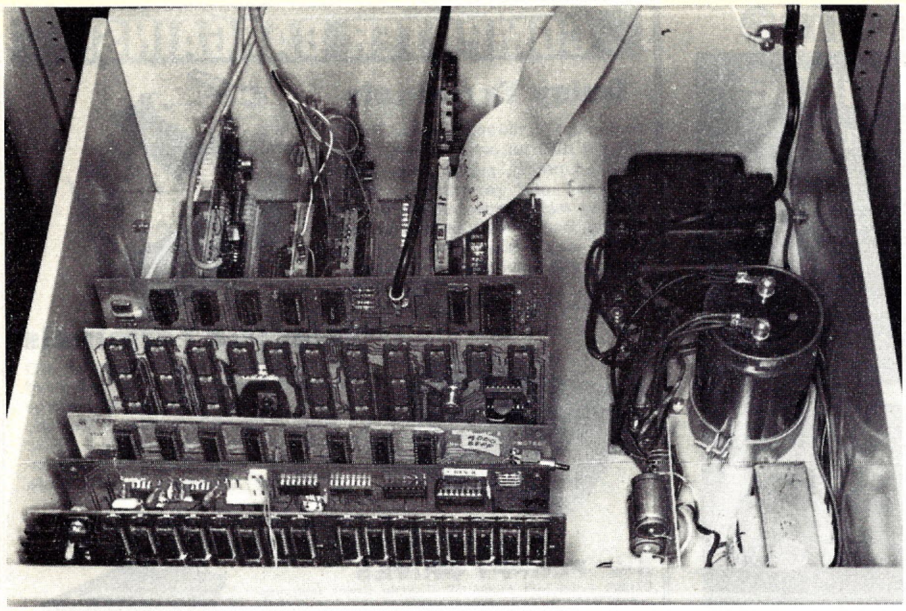


Photo 1. SWTP motherboard and a slightly modified power supply fit inside the drawer I chose with room to spare.

cided to mount my system in a rack.

Metal racks are commonly used to hold electronic equipment in industry. A typical rack is slightly over 20 inches wide, and about as deep. The height may vary from ten inches for a desk-mount cabinet, to as high as seven or eight feet. The front of the rack is generally open, and a pair of rails along each side contains screwholes for mounting panels, drawers or other system components. Front panels are mostly 19 inches wide, and hence the rack is often called a 19-inch rack.

As shown in Photos 1 and 2, the system is mounted in a pull-out drawer (from Premier Metal Products Company, 381 Canal Place, Bronx, NY 10451), which measures 16 by 16 inches, and is a perfect fit for my SWTP motherboard and power supply. I used 10½-inch-high drawers (model TDR- 1014) for each system, and a seven-inch-high drawer (model TDR-719) for an extra power supply.

Accessories such as disk drives are mounted on slide-out shelves (model TWS-319). The drawers and shelves are mounted on metal slides and can be slid completely out the front of the rack, so it is easy to work on any part of the system. The only problem has been with an occasional wire getting stuck in the back as a drawer or shelf is pulled out.

I keep the front of the drawer open slightly to allow heat to escape, but a fan may eventually be needed.

Heat Dissipation of Static Memory Boards

Since I needed memory for my 6809 system, I purchased the new 32K byte static-memory board kit from Digital Research Computers of Texas (PO Box 401565, Garland, TX 75040). Although this board is available in kit form or wired, I chose the *board plus support integrated circuits (ICs) plus sockets* approach; at $90.95 for a complete kit which includes everything except the memory chips themselves, this is an excellent buy.

The board uses 64 type 2114L RAM ICs; Digital Research specifies that these must be low power, and here is where I ran into some difficulties. I soon discovered that not all low-power ICs are the same.

I bought 64 ICs at $2.98 each from Active Electronics. The total power drain for the board with 32K of RAM installed is about 2.8 amperes, and the board runs quite warm. Although it is perfectly suitable for a cabinet with an open top, such as my original SWTP box, it is too warm for my unventilated rack.

I subsequently discovered that even lower-power 2114 ICs are available. For example, Gimix uses Japanese 2114L RAM memories in their 32K static board, and that board takes under 2 amperes as opposed to my 2.8 amperes. This makes a big difference on a board where the memory

chips are so close to each other as to almost touch. (With Gimix now selling their ICs at a very attractive price, this would have been a very good combination.)

The Digital Research board itself is of excellent quality, with silk-screening and extended addressing options. Given the right low power ICs, it is an excellent way of providing economical static memory for a system. In my case, though, I did not have sufficiently low power ICs for my closed, unventilated cabinet.

Rather than switch all 64 ICs, I switched to a different memory board—the 64K byte dynamic RAM board from Boaz Co. (Box 18081, San Jose, CA 95158). Though this board is somewhat more expensive (ranging from $80 for a bare board to $250 for an assembled board without the dynamic RAM ICs), the memory chips themselves are cheaper. This board uses the same 4116 (16K by 1 bit) chips as used in the TRS-80, Apple and many other systems. Current prices of 16K upgrades for these computers are as low as $17, with the result that even 64K of RAM chips cost under $70.

This board has solved my problems. Even with 64K of RAM installed (though not all is switched in due to address conflicts with the monitor and I/O) the board runs much cooler than any static memory, with the possible exception of the new static RAMs such as are available for Gimix.

SWTP MP-09 CPU Board Modifications

The next step was to modify my HUMBUG monitor to allow it to run on the 6809, so that I could have all the functions I had on my 6800. More problems.

My 6809 HUMBUG occupies two 2716 (erasable-programmable read-only memory) (EPROM) chips and has some very useful debugging and troubleshooting commands. Unfortunately, it didn't always work. It worked in one processor board, but not in another. Neither board worked in a different system. And some 2716s worked, others did not. Not knowing whether the problem was with my hardware or software, I obviously suspected the software. But that did not seem to lead anywhere, so I eventually transferred SWTP's SBUG monitor into a 2716, and that also didn't work.

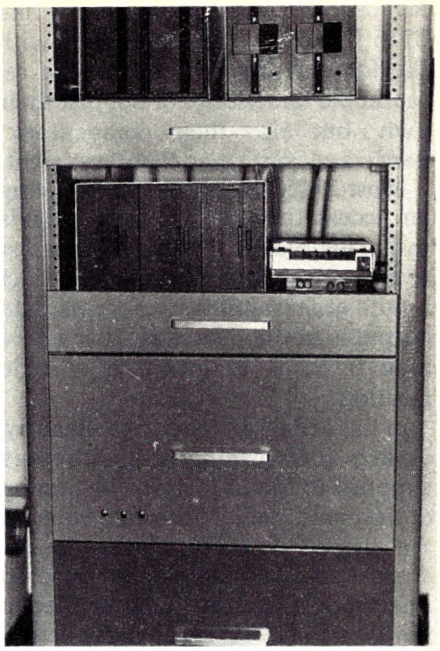


Photo 2. Mounting the 6809 system in a standard 19-inch rack provides a compact and neat installation.

I eventually decided that the SWTP

MP-09A CPU board just did not like 2716 EPROMs. A conversation with the folks at Gimix (who have a remarkable knowledge of not just their own, but also their competitors', hardware) confirmed that I was right.

Most 2716s are specified as having an access time of 450 nanoseconds (ns). This means that the 2716 must receive its address and chip select inputs at least 450 ns before its data output is needed, because that's how long it takes to access a specific location.

In the MP-09A board, one memory cycle is 1000 ns long. The address is supplied to the 2716 at the beginning of the cycle, and the data is needed at the end of the cycle. Hence the address is supplied in time. But the chip select (which is a low pulse applied to pin 18 of the 2716) is not applied until about halfway through the cycle, leaving the 2716 about 400 to 500 ns to finish its job. This is just barely enough time, as most commonly available 2716 EPROMs are specified for an access time of 450 ns. Such a 2716 will occasionally output the wrong data. (Now I finally understood the comment in the SBUG manual that when SBUG was burned into a 2716, the system could not run faster than a 1 MHz clock speed.)

There are several solutions, such as slowing down the system clock, lengthening clock pulses during ROM accesses and so on. An obvious answer is to use a faster 2716 EPROM. The 2716 is available in 450, 350 and 250 ns access times. The 350 ns part works in almost all cases, though the 250 ns part may have a somewhat greater safety factor. The disadvantage is that these faster EPROMs are more expensive, and difficult to get. I called a dozen suppliers who advertise 2716s in the popular magazines, and not one had anything faster than 450 ns.

The correct, though not necessarily simplest, solution is to fix the 2716 timing problem. This involves cutting the printed circuit board trace which leads to pin 18 of each 2716 socket, and grounding pin 18 to keep the 2716 selected at all times; this works since the same select signal also goes to the $\overline{\text{OE}}$ pin (pin 20) of the 2716, and this pin takes over the selection job; it does not have the same delay as pin 18 does.

Unfortunately, the trace which needs cutting is under the 2716 socket. In my case, the sockets were open in the center and so a thin knife reached the trace; in some cases it may be better to bend pin 18 so it does not go into its socket, and ground it through a separate jumper.

MP-R Programmer Notes

The MP-R programmer is normally supplied with a cassette that contains 6800 software. New EPROM programmers are supplied with SWTP Application Notice AN-109, which mentions that READPROM and WRITPROM utilities, which read and program 2716 EPROMs under FLEX 9, are available, along with FLEX 9, from SWTP for $10.

READPROM and WRITPROM essentially transfer data from disk to EPROM or vice versa. They are not nearly as versatile as the original 6800 program, which allowed a 2716 to be verified, or which allowed partial programming. There is a need for someone to develop better programmer software, especially for those people who are using 6809 systems without FLEX 9.

See List of Advertisers on page 210

6809 FLEX Versions

Although FLEX is a product of Technical Systems Consultants, several hardware manufacturers have licenses to modify it for their systems and sell the modified versions.

Although the terms of the license agreements specify that the modifications must be such that the modified systems must still be able to read and write standard unmodified disks and run standard software (such as TSC BASIC), the modified versions of FLEX will generally only run on the equipment they are designed for.

The two biggest FLEX licensees are probably SWTP and Gimix. SWTP modifications to FLEX concentrate mainly on making it compatible with all the various SWTP 6809 mainframes.

At present three different SWTP 6809 system configurations are supported:

The /09 system is generally a 6800 system with an MP-B or MP-B2 motherboard, which has been converted by the installation of an MP-09 board. Since this configuration uses the 6800-style motherboard (with modifications to move I/O from address 8000 (hexadecimal) to E000), I/O ports use four addresses per slot. Older, 6800-style I/O boards are used including the MP-S and MP-LA boards. This system does not use extended addressing, and is therefore limited to a maximum of 56K bytes of RAM.

The 69A and 69K systems are the assembled and kit versions, respectively, and use the newer MP-B3 motherboard. These systems are also limited to 56K of RAM, but use the newer I/O bus structure which devotes 16 addresses per I/O slot instead of four used on 6800 systems. For example, port 7 in the /09 system is at address E01C (hexadecimal), whereas in the 69K or 69A it is at address E070. This requires that the newer MP-S2 and MP-L2 interface boards be used. (Older I/O boards can be used with the new addressing modes, but not vice versa, since the new boards do not fit into the older mainframes.)

Finally, the S/09 system uses the even newer MP-MB motherboard. I/O ports again use 16 addresses per slot and require the newer I/O boards; in addition, this motherboard allows extended RAM addressing, so that a total of 384K bytes of memory can be used (consisting of three 128K RAM boards). Since the extended address lines are placed on the bus pins formerly used by the data rate lines, data rate signals must be generated separately. This system therefore has an additional plug-in board called the MP-ID, which contains the data rate generator as well as a parallel output port and interrupt timer. This board is located at address E080.

SWTP versions of FLEX include extra code (which is only run when the system is first booted) to test the system and set appropriate flags to indicate which system is being used. They also check the extent of memory (including testing for extended memory) and configure the dynamic

How Readable Is this Article?

The June 1981 issue of *Kilobaud Microcomputing* had an interesting program, written by Richard R. Parry, for analyzing written text. The idea is to grade an article or other text to see how well it is written, and how well it might be understood by the typical reader.

A similar program (though written in assembly language and therefore much faster, as well as more complete) is available from the Frank Hogg Laboratory (130 Midtown Plaza, Syracuse, NY 13210). Written by Dale Puckett, the READTEST program is a very useful addition for anyone who does a lot of writing. (Dale Puckett also wrote the ESTHER program available from the Hogg Laboratory. ESTHER is similar to the well-known ELIZA program, but much better than the usual microcomputer implementations).

READTEST reads a text file from disk, and analyzes it for content. It counts the number of words and sentences, as well as the types of words. After computing the average sentence length and other facts about the text, READTEST then prints out a short critique of how well it is written.

(Hm. . . if I were an English teacher, could I have my students type their papers into the computer, and then have the computer do the grading? Cute idea. . .)

To see how well this article stacks up (in its original form, before the editors fix all my mistakes), I ran READTEST on it. Listing 3 shows the program's output, which I'm including here without editing. . . and without comment.

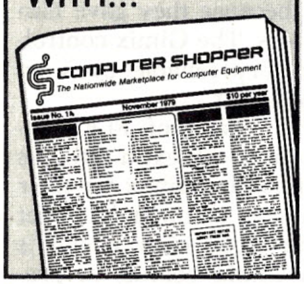
```
Number of lines = 748
Number of words = 6628
Number of sentences = 377
Number of proper nouns = 458

Now counting personal words and affixes . . .

Number of personal words = 133
Number of affixes = 2834
Average sentence length = 17

Based on the average sentence length your rating is:
AVERAGE

Based on the number of affixes your rating is: VERY EASY

Based on the number of personal words, your rating is: INTERESTING; similar
to material found in the digests.

Your overall readability index is: 118

This means your story is . . . EASY
READING.  A fifth grader can understand it. Eighty-six percent of the
population can handle it.  It is similar to material found in paperback
fiction.

Hopefully, you are pleased with your rating. If not, why not rewrite the
story in an effort to communicate more effectively. Think short words,
short sentences, and short paragraphs. Do not be discouraged.  Writing
for any practical purpose is a difficult and ellusive art.  Remember,
Ernest Hemmingway often spent eight hours writing four or five hundred
words.

                          G O O D   L U C K
```

Listing 3.

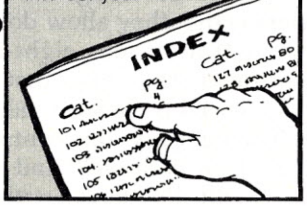
How to Buy or Sell Computer Equipment and Software

and come out a winner

START HERE WITH...



Begin your search in the index of Computer Shopper's bargain filled pages. Locate the category and page number of items that interest you.



Computer Shopper's easy-to-read format makes your search quick and simple with classifications at the top of each column in bold black headings.

Start or add to your computer system by finding money saving bargains in each month's issue from individuals who no longer need their personal equipment.

You've got your computer hardware, but what about the software? Use a Computer Shopper ad to find what you need. Someone advertising in Computer Shopper probably has what you want.

You have the convenience of shopping nationwide without ever leaving your home or office. And if you buy out of state you'll save on sales tax.

If you need help with any computer related problem whether it's an interface problem or advice on the right peripheral for a homebrew system, use the free HELP column especially designed for that purpose.

As you outgrow your system or want to trade up (most dealers won't take trade-ins), use Computer Shopper ads to sell your items to 20,000 readers nationwide for the low cost of 10 cents per word.

Congratulations, you're a winner whether you buy, sell or trade in the computer marketplace by subscribing and using Computer Shopper's action yellow pages. And for your first bargain, take advantage of a FREE issue of Computer Shopper as a "Special Get Acquainted Offer."

Act today and receive your first issue free in addition to the $10, one year/12 issue regular subscription. Of course, if you are not 100% satisfied, you may cancel and still keep the free issue just for trying Computer Shopper.

BONUS: New subscribers are entitled to a complimentary classified ad. Use it for pre-owned equipment or software or as a want-to-buy ad. Just print or type your ad on a plain piece of paper and send it along with your subscription. Your phone will probably start ringing before you receive your first issue.

For MasterCard and VISA Subscriptions only,
CALL TOLL FREE 1-800-327-9920

For MasterCard and VISA Classified Ad orders only,
CALL TOLL FREE 1-800-327-9926

COMPUTER SHOPPER 36

P.O. Box F137 • Titusville, FL 32780
Telephone 305-269-3211

address translator (DAT) on the processor board. These FLEX versions are currently supplied by SWTP only for newer disk controllers, and hence the required modifications to make them work with older disk controllers are described in several of the Application Notices.

Gimix versions of FLEX are also customized to fit their hardware. Gimix currently has three different disk controllers available, and so Gimix supplies three different versions of 6809 FLEX rather than trying to have one version support all controllers.

The 5/8 disk controller can be used with either 5-inch or 8-inch drives on 6809 systems, and with 5-inch drives on 6800 systems. On 6809 systems it can be used with two-sided drives as well as double-track drives (which provide 80 tracks per side), but only in single density. This is the simplest of Gimix's three controllers, but unlike some of the equivalent controllers of other manufacturers, this one has a data separator and somewhat better design. As a result it is far more reliable and does not require periodic disk re-reads.

The double-density programmed I/O (PIO) controller works only with five-inch drives on 6809 systems but allows double-density and/or double-sided and/or double-track operation. On a standard drive such as a Shugart SA-400, this controller provides 612 256-byte sectors for a total storage of 152K bytes in double density. Using an MPI model 92 drive, on the other hand, adds double-sided operation plus the capability to use 80 tracks on each side. This provides 2844 sectors of 256 bytes each, for a total of 711K per disk.

Finally, the DMA disk controller allows all of the above options, and uses direct memory access (DMA) data transfer instead of programmed I/O. The major advantage of DMA controllers is that they allow double-density operation on eight-inch drives without requiring that the CPU clock speed be raised to almost 2 MHz. Theoretically, this controller can be used on both 6800 and 6809 systems; practically, though, only the 6809 is supported by Gimix.

For my separate 6809 system I chose the double-density PIO controller along with a pair of MPI 92 disk drives. (It is staggering to realize that the resulting 1422K bytes of disk storage is more than that of the IBM 1130 computer I have used at work for the last ten years.) Though this controller and drive combination is more expensive than those used on my 6800 system, I made the choice simply because here, at last, was something the 6809 could do that my 6800 system could not.

Although these drives use both sides of each disk, I use standard single-sided disks (like the Verbatim MD-525-01) with no difficulty. In fact, I have no trouble using some disks that have been discarded by a TRS-80 user because they gave him too many errors. The Gimix controller is really very reliable even on such unusable disks.

The Gimix version of FLEX includes a number of extra utilities that are supplied by Gimix for their systems, such as commands to set and read the clock chip which is available on Gimix boards, or provide data to the arithmetic chip which is also on some processor boards. But it is the FLEX extensions that are most interesting.

Instead of a NEWDISK utility, Gimix supplies a FORMAT program to format a blank disk. It prompts for a number of options, including single- or double-density operation, single or double sides, and the number of tracks to be formatted. This latter option is especially handy if you just need a few tracks for a temporary file, since formatting can take a long time for an 80-track, double-sided disk.

Another useful utility called SETUP is used to modify various drive parameters. As supplied, FLEX assumes that slow drives (having slow track-to-track movement) are used, but the SETUP utility can be used to change the speed at which FLEX moves the head to match the drive used. This is particularly handy when several different drives are used, some slow and some fast. Another function is to tell FLEX how many drives are actually on the system, so that the system does not hang up if a nonexistent drive is specified in a command.

80-track drives are normally incompatible with 40-track drives, but Gimix FLEX can be configured to skip alternate tracks so that an 80-track drive can read or write a 40-track disk. This makes it possible to interchange disks with systems using other types of drives and controllers.

There is only one disadvantage I can think of in having so much disk storage (aside from the fact that one gets very sloppy when there is so much empty room). Since it is possible to put hundreds of files on one disk, the directory grows large too. On FLEX, the directory starts on track 0, and so directory accesses are fast when the directory is small. But once there are more than a few dozen entries, the directory is continued on inner tracks, with the result that each directory read or write—of which there are many in normal operation—involves extensive head movement.

This can slow down operation quite a bit. Fortunately, Gimix supplies an EXTEND utility to extend the directory size. When used on a new, freshly-formatted disk, EXTEND adds up to ten more sectors to the directory. Since these new sectors

SWTP Application Notices

The 6809 system takes just a few paragraphs to describe, but in reality it took months of experimenting to figure it out. And then I discovered that SWTP had issued some Application Notices describing this fix, as well as other fixes, and that I could have saved myself all this work if I had known about them.

Since I have discovered many other SWTP owners who do not know about these notes, here is a listing of what is available at the time of writing, though more Application Notices will probably exist by the time this appears in print. As I have been unable to get an index or the notes themselves from SWTP, I suspect that you will have to contact your local SWTP dealer for a copy.

Many of the changes or suggestions have been included with systems shipped after the date of the note, so even if a note applies to your equipment, it may not be necessary to get it unless the problem exits.

AN-101 (11-15-79). S/09 memory tests booting DMAF disks and system jumpers.

AN-102 (11-21-79). Using the DMF-2 controller on 6800 systems, or with Calcomp 143 drives.

AN-103B (10-31-80). Notes on using the CDS-1 hard disk.

AN-104 (12-13-79). Modifying the MP-09 CPU board into an MP-09A board. If your CPU board works, then it has already been modified.

AN-105 (12-13-79). Notes on using the MP-09 or MP-09A CPU board in 6800 or /09 mainframes.

AN-106 (12-14-79). Using the DC-2 disk controller on MP-B3 or MP-MB motherboards.

AN-107 (1-2-80). Differences between SWTP 6809 systems, and patches to FLEX 9 versions 2.4 and 2.5.

AN-108 (1-8-80). Modifying the MP-S serial I/O board for printer handshaking.

AN-109 (1-8-80). 6809 software notes for the MP-R programmer.

AN-110A (2-14-80). How to use the Centronics 704 printer with SWTP computers.

AN-111 (1-23-80). More patches to FLEX versions 2.4 and 2.5 and notes on maximum file size.

AN-112 (1-25-80). Using serial printers with Multi User BASIC.

AN-113 (2-26-80). Using FLEX version 2.6 with the MP-B3 motherboard.

AN-114A (9-8-80). DMF2 controller address decoding, and operation with UNIFLEX.

AN-115 (4-25-80). Adjustments for Zenith monitors in some CT-82s.

AN-116A (7-2-80). Using the SWTP Editor with printer spooling, etc.

AN-117 (5-7-80). Modifying the 6800 MP-A CPU board for use with the DMF2 disk controller.

AN-118 (5-19-80). Notes on using the MP-S2 serial interface.

AN-119 (5-23-80). Testing 128K RAM boards with SBUG.

AN-120 (7-16-81). Unpacking and packing QUME eight-inch drives.

AN-121 (7-24-81). Notes on the CDS-1 hard disk.

AN-122A (11-14-80). Updating S/09 systems to work with FLEX or UNIFLEX. Updates MP-09 CPU board to revision C, MP-MP motherboard to revision A, and MP-ID board to revision C.

AN-123 (10-16-80). Patches to FLEX version 2.6 for Shugart drives.

AN-124 (10-21-80). Operating the S/09 at 2 MHz.

AN-125A (1-8-81). Using FLEX version 2.7 with the DC-2, DC-3 and DMF1 controllers, and Shugart or Calcomp drives.

AN-126 (11-6-80). Using the Centronics 737-1 printer.

AN-127 (12-10-80). Modifying the MP-09 and MP-09 CPU boards.

AN-128 (12-11-80). Modifying the CDS-1 power supply.

AN-129 (1-23-81). Modifying 128K RAM boards for 2 MHz operation.

AN-130 (2-17-81). Modifying 69/A and 69/K computers for 2 MHz operation.

I found several of the above notes useful, especially AN-127 that told me how to fix my MP-09 processor board. Also useful was AN-109, which provided information on using my MP-R 2716 programmer on the 6809 system.

are on track 1, the disk head need move at most one track to get from the beginning of the directory to the end. Quite a difference.

6809 Advantages over the 6800

Having gone to a lot of effort to build a 48K 6809 system in addition to my present 50K 6800 system, there is the inevitable question of which I prefer.

The 6809 is potentially more powerful, but not without quite a bit of additional expense.

In the hardware area, my 6809 has about 1½ million bytes of storage with two disk drives. That could not be achieved with five-inch drives on my 6800 at all.

The real potential of the 6809, of course, is in the software. Until recently, most 6809 software was simply reassembled from original 6800 source code, and thus had very little advantage over the 6800. For example, I recently wrote a spelling-correction program called Magic Spell in 6800 code, and then reassembled it for the 6809. The 6809 version runs 10 or 20 percent faster, hardly enough to make much difference.

Now, however, more and more software is being developed strictly for the 6809. Though the change can be seen in all sorts of application software, it is most apparent in system software such as disk operating systems.

Though FLEX is by far the most popular, it does not really differ much from its 6800 version. But there are two other disk operating systems which run specifically on 6809 systems.

For big-system users (more than 64K) there is UniFLEX from Technical Systems Consultants (Box 2570, West Lafayette, IN 47906). This DOS is based on the famous UNIX system developed at Bell Laboratories, and is extremely capable. It is, however, definitely not for the small user. Not only is a very large amount of memory required, but the UniFLEX manual even suggests that each UniFLEX installation requires a system manager to oversee it, and larger installations may even require two such persons.

A much more accessible DOS for the small user (though very usable on large systems as well) is OS-9 from Microware Systems Corp. (5835 Grand, Des Moines, IA 50312). OS-9 is actually available in two versions—Level 1 for systems under 64K, and Level 2 for systems over 64K.

Both UniFLEX and OS-9 support multitasking and multi-user software, which makes them ideal for the business user who may want to have several operators working on the same data files.

From the viewpoint of the hobbyist or personal computer user, their advantage is less clear. While it might sometimes be convenient to do two things at the same time (edit an article while running a big BASIC program, for instance), this is not so important to the small user.

A major disadvantage—at least from my point of view—is cost. Switching to a new DOS such as UniFLEX or OS-9 obsoletes all existing software. The cost of converting to either UniFLEX or OS-9, including a new DOS, BASIC interpreter, editor, assembler, text processor and perhaps other software as well, is in the area of $1000.

Perhaps that explains why I decided to keep my 6800 system and build a separate 6809 system. The two systems give me the capability of running two programs at the same time, and do it more cheaply than completely switching to the 6809 and getting an advanced DOS. This way I have multitasking, multiprocessing, and multiprogramming (multi- being defined as two-).

Besides, I like the 6800. ■

68xx Bulletin Boards

There are currently three 68xx-based computer bulletin boards that I know of:

904-477-8783 in Pensacola, FL, is run by Don Wright, and uses a tape-based 6800 system. Runs close to 24 hours a day.

215-435-3388 in Allentown, PA, is run by Lehigh Press, and uses a disk-based 6809 system. Also 24 hours a day.

914-241-0287 in Mt. Kisco, NY, runs on either my 6800 or my 6809 system, whichever is free at the time. This number is answered either by me or an answering machine during the day; the bulletin board program runs evenings, usually until around midnight. If you have any comments or suggestions for future articles, that's a good way of getting them to me.

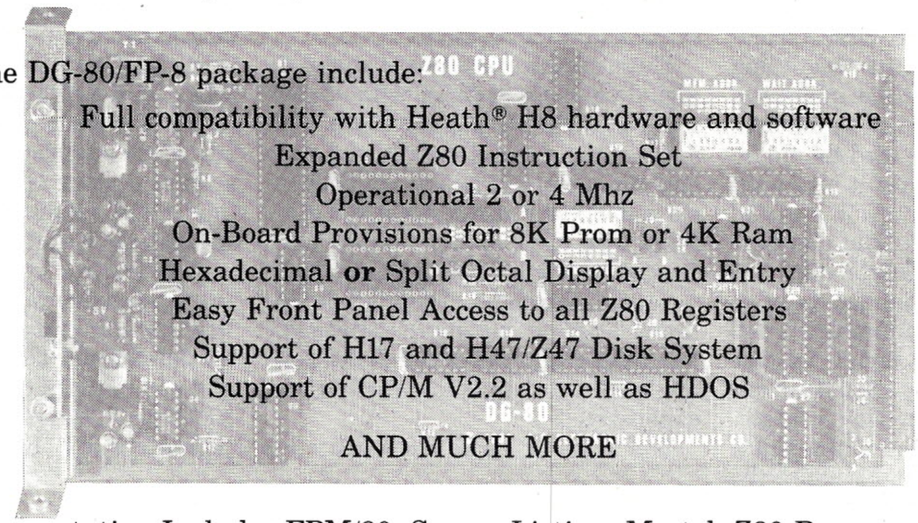
See you next time.

DON'T BUY A Z80!

(without Front Panel Support)

The H8/Z80 combination is nothing more than a glorified 8080 system **unless** you have the front panel monitor support to access the additional power of the Z80 CPU. The expanded instruction set, alternate registers and enhanced interrupt capability of the Z80 are all wishful dreams if inaccessible to the user.

DG offers the H8 owner not only the finest Z80 CPU board available today but also the monitor necessary for its use. The DG-FP8 hardware/firmware package featuring our versatile FPM/80 monitor provides all of the features and facilities of the Heath® PAM 8 monitor as well as the advanced monitor capabilities necessary for optimum utilization of the DG-80 Z80 CPU.



Features of the DG-80/FP-8 package include:

Full compatibility with Heath® H8 hardware and software
Expanded Z80 Instruction Set
Operational 2 or 4 Mhz
On-Board Provisions for 8K Prom or 4K Ram
Hexadecimal **or** Split Octal Display and Entry
Easy Front Panel Access to all Z80 Registers
Support of H17 and H47/Z47 Disk System
Support of CP/M V2.2 as well as HDOS

AND MUCH MORE

Complete Documentation Includes FPM/80, Source Listing, Mostek Z80 Programming Manual, Operations Manual and Complete Installation Instructions.

Wait no longer, **everything** you need to use the Z-80 to its and your full advantage is available TODAY with this unique package!

Both DG-80 and FP-8 For Only $249.00

DOCUMENTATION ONLY: $30.

CP/M is a registered trademark of Digital Research of Pacific Grove, California. Heath, H8, & PAM8 are registered trademarks of the Heath Company. Z80® is the registered trademark of Zilog Corporation.

D·G ELECTRONIC DEVELOPMENTS CO. ✓145

Ordering Information: Products listed available from DG Electronic Developments Co., 700 South Armstrong, Denison, Tx. 75020. Check, Money Order, VISA or MasterCard accepted. Phone orders call (214) 465-7805. Freight prepaid. Allow 3 weeks for personal checks to clear. Texas residents add 5%. Foreign orders add 30%. Prices subject to change without notice.

✓See List of Advertisers on page 210

Let your digital machine tune into the analog world with this inexpensive, yet fast, multichannel analog-to-digital converter.

The Best of Both Worlds

By Gordon Wolfe

What a marvelous thing the computer is! It can take numbers and add or subtract them, multiply or divide, perform all manner of functions, store them, manipulate them and spew them forth in a torrent of paper. Any mathematical operation on numbers that can be conceived by man can be performed by the computer.

But where does the computer get its numbers to begin with?

Suppose you, like me, were a scientist doing experiments involving measurements of electrical quantities from some sensor device. In the simplest case, you would read the quantity from a meter, enter it into your data book and later key it into the computer for analysis. The numbers are generated by the keyboard.

But notice what happened—you've been reduced to an information collection and storage device for the computer. Computers should be our servants, not the other way around.

It would be much more efficient if the computer itself could obtain the numbers directly from the measuring device. After all, they're both electronic, aren't they?

It turns out that such a thing is possible, but that, generally, two such devices as a transducer and a computer are not fully compatible. The computer is a digital instrument, which recognizes only "on" or "off."

We live in an analog world—very few measurements are "yes" or "no" in nature. For example, the output of an X-ray detector might be 8.0 V, meaning that a 12,000 V X-ray entered the detector. There are many other examples, such as the setting of a potentiometer or the output of a thermocouple, which give a voltage proportional to some physical value.

Address correspondence to Dr. Gordon W. Wolfe, 1513 N. Sibley, Metairie, LA 70003.

The Conversion Process

This voltage must be converted to a series of on-off signals that a computer can understand. This process is called analog to digital conversion, and is the centerpiece of any computer measurement system.

There are several types of analog to digital converts (ADCs), with advantages and disadvantages to each. The single-ramp type is usually simplest and cheapest, but is slow in conversion and may suffer linearity problems (see my article "Innovative Tech's Analog-to-Digital Converter," p. 176, December 1980). Double-ramp is faster, but more expensive. Successive approximation is the fastest, most accurate and usually most expensive.

The type of ADC used must be matched to the type of signal to be digitized. For dc signals, almost any type will do. For ac signals, such as speech recognition, a faster ADC will be required, with the speed requirement increasing with the ac frequency. Pulse height analysis, where you need to measure the maximum amplitude of a short voltage pulse, has one of the most difficult requirements. These types of pulses (Fig. 1a) are encountered often in science. In charge-particle physics, for example, a charged ion will deposit its energy (Fig. 1b) in a detector (which is really just a reverse-biased diode) and create electron-hole pairs, which are seen as a pulse of current across the diode. The height of the pulse gives a measurement of the energy of the ion.

The problem comes in measuring the maximum value of the pulse—how do you know when to take the measurement? Too soon or too late, and you miss the peak. Suppose your ADC has a conversion time of 500 μs (microseconds), but the pulse is only

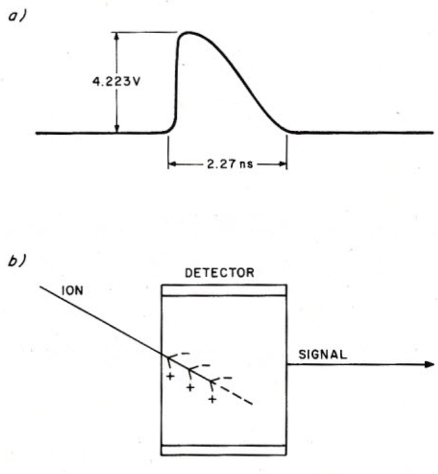


Fig. 1. a) Fast pulse whose amplitude is to be determined. b) Source of the pulse—an ion depostis its energy in a detector.

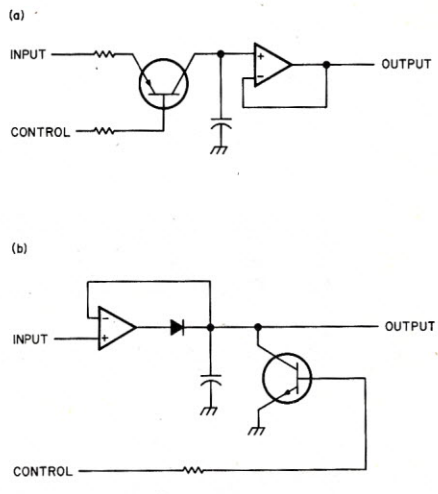


Fig. 2. a) Sample and hold circuit. b) Peak holding circuit.

2 μs wide. What do you do then?

Usually, the matter is taken care of by signal holding. The voltage to be measured is placed onto a capacitor, with no means of leakage off until the measurement is finished. If this is to be done at a specific time, a sample and hold circuit is used. If you want to measure a peak, you use a peak sensor circuit. Fig. 2 shows examples of each of these.

Also, most ADCs have a comparator within them, which compares the input signal with some known fraction of a reference voltage. An ADC is only as good as the accuracy of the comparator and the precision of the reference voltage.

An Application

The particular application I had was a combination of several types of data-taking, which required a fast "universal" analog-to-digital converter. My work at the University of Mississippi is research into the make-up, production and transport of air pollution. I do this by drawing large quantities of air through a filter, and analyzing the filter with X-rays. Sometimes the samples are liquified gases as well.

The X-rays arrive at random times, and are transformed into electrical pulses whose height must be measured. The energy spectrum is displayed on an oscilloscope in real time, and sometimes modifications to the acquisition routines must be made while the analysis is going on. This is done by interacting with the display via a joystick, whose value is displayed with the spectrum.

So I need to measure two channels of pulse heights at random times as needed by incoming data, two channels of dc voltages, on demand by the computer, and maybe one channel of temperature dc if liquid gases are involved.

What I really need, then, is an ADC that can do dc or pulse height, whose function can be started by the experiment *or* by the computer, with at least 256 channels of resolution (eight-bit output). With 5-V signals, this means accuracy to about plus or minus one millivolt. Also, I need a conversion time less than 100 μs.

Such devices are on the market. One made specifically for the purpose outlined above sells for $1650, and $475 for the precision power supply. Too much for my pocketbook. I was determined to build my own.

I had begun to design such a device when I ran across an advertisement for the National Semiconductor ADC 0817 integrated circuit. (See Figs. 3 and 4.) This chip is designed to be the centerpiece of a data acquisition system such as mine. It has eight-bit resolution with tri-state outputs, fast successive approximation conversion methods and a 16-channel analog data multiplexer so that up to 16 analog channels may be digitized. Best of all, it has a conversion time of only 90 μs at the 875 kHz clock rate I use, and a whole acquisition system may be constructed for less than $70.

The circuit I eventually came up with is shown in Fig. 5. Fifteen of the sixteen analog inputs are usable. Seven inputs are controllable by external strobes, and eight are controllable by the computer through data lines PA4 through PA7. The only

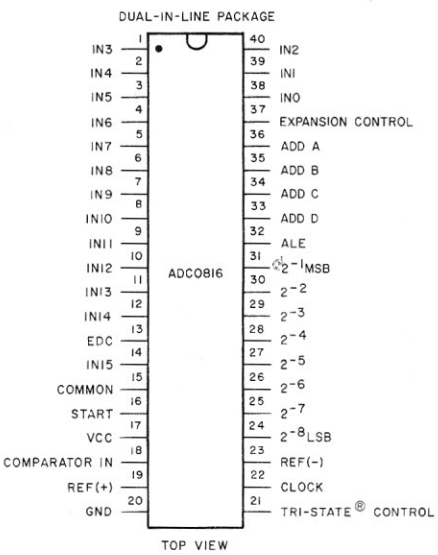


Fig. 3. Pin-out diagram of the ADC0817 (courtesy National Semiconductor).

```
ADC
SSB MNEMONIC ASSEMBLER  PAGE 1

                    NAM    ADC
                    OPT    NOP
               *
               *HANDLER FOR ADC0817
               *CIRCUIT WITH 15 COMPUTER
               *SELECTABLE INPUTS,7
               *EXTERNAL SELECT INPUTS
               *
A020           XTEMP  EQU    $A020
8018           PIAADC EQU    $8018
               *
DA00                  ORG    $DA00
               *
               *ROUTINE TO CALL DATA
               *INPUT CHANNEL
               *CHANNEL NO IN A
               *
DA00 81 0E     CALDAT CMP A #14
DA02 2E 60            BGT    ERROR
DA04 48               ASL A
DA05 48               ASL A
DA06 48               ASL A
DA07 48               ASL A
DA08 B7 8018          STA A PIAADC
DA0B 86 FF            LDA A #$FF
DA0D B7 8018          STA A PIAADC
DA10 3E               WAI
DA11 39               RTS
               *
               *PIA INITIALIZATION
               *A SIDE 0-3 INPUT
               *A SIDE 4-7 OUTPUT
               *B SIDE INPUT
               *CB1 INTERRUPTS ON
               *HIGH  TO LOW TRANSITION
               *
DA12 CE 8018   ADCSET LDX    #PIAADC
DA15 6F 00            CLR    0,X
DA17 6F 02            CLR    2,X
DA19 86 F0            LDA A #$F0
DA1B A7 00            STA A 0,X
DA1D 6F 02            CLR    2,X
DA1F 86 04            LDA A #$04
DA21 A7 01            STA A 1,X
DA23 86 05            LDA A #$05
DA25 A7 03            STA A 3,X
DA27 39               RTS
               *
               *INTERRUPT SERVICE ROUTINE
               *EXECUTES ONE OF 15
               *DEPENDING ON ADDR
               *IN PIAA 0-3
               *
DA28           TABLE  EQU    *
DA28 D9 00     ROUT0  FDB    $D900
DA2A DA 60     ROUT1  FDB    DONE
DA2C DA 60     ROUT2  FDB    DONE
DA2E DA 60     ROUT3  FDB    DONE
DA30 DA 60     ROUT4  FDB    DONE
DA32 DA 60     ROUT6  FDB    DONE
DA34 DA 60     ROUT7  FDB    DONE
DA36 DA 60     ROUT8  FDB    DONE
DA38 DA 60     ROUT9  FDB    DONE
DA3A DA 60     ROUTA  FDB    DONE
DA3C DA 60     ROUTB  FDB    DONE
DA3E DA 60     ROUTC  FDB    DONE
DA40 DA 60     ROUTD  FDB    DONE
DA42 DA 60     ROUTE  FDB    DONE
DA44 DA 62     ROUTF  FDB    ERROR2
               *
DA46 0F        DATAIN SEI
DA47 B6 8018          LDA A PIAADC
DA4A 84 0F            AND A #$0F
DA4C CE DA28          LDX    #TABLE
DA4F FF A020          STX    XTEMP
DA52 48               ASL A
DA53 BB A021          ADD A XTEMP+1
DA56 24 03            BCC    SERVE
DA58 7C A020          INC    XTEMP
DA5B FE A020   SERVE  LDX    XTEMP
DA5E AD 00            JSR    0,X
DA60 0E        DONE   CLI
DA61 3B               RTI
               *
DA62 20 FC     ERROR2 BRA    DONE
DA64 39        ERROR  RTS
               *
                      END
     NO ERROR(S) DETECTED


  SYMBOL TABLE:
ADCSET  DA12    CALDAT  DA00     DATAIN
  DA46     DONE    DA60
ERROR   DA64    ERROR2  DA62     PIAADC
  8018     ROUT0   DA28
ROUT1   DA2A    ROUT2   DA2C     ROUT3
  DA2E     ROUT4   DA30
ROUT6   DA32    ROUT7   DA34     ROUT8
  DA36     ROUT9   DA38
ROUTA   DA3A    ROUTB   DA3C     ROUTC
  DA3E     ROUTD   DA40
ROUTE   DA42    ROUTF   DA44     SERVE
  DA5B     TABLE   DA28
XTEMP   A020
```

Listing 1. ADC program for a 6800-based system.

input that is not usable is number fifteen, corresponding to input pin IN15, which is address 1111 from the A-side of the PIA. Sending a 1111 from PIA lines PA4 through PA7 will have no effect.

The ADC 0817 (IC8) does the majority of the work. It does the analog-to-digital conversion of the analog input whose hexadecimal channel number is presented at the address inputs. The data outputs and an end-of-conversion signal are sent to the B-side inputs of a 6820 PIA.

IC10, the IN914 diode, capacitor and transistor form a peak-sense-and-hold amplifier on the output of the analog multiplexer. The capacitor is charged by IC10 to the maximum voltage of the input being sampled, and since there is effectively no leakage current, will maintain this voltage at the input of the ADC until the end of the conversion, when the transistor shorts the capacitor to ground. Do not substitute for IC10. Most general-purpose op-amps and comparators are simply not fast enough for this application.

IC5 is the precision voltage reference for the ADC. It is an analog devices AD584 chip, and can be programmed for 10.000, 7.500, 5.000 or 2.500 V, plus or minus one millivolt. It is essentially a precision, low-power voltage regulator. You might be tempted to use this chip as a power supply for the whole conversion circuit, but that isn't a good idea. The AD584 can only source or sink up to 15 mA, and precision suffers above 10 mA. In this circuit it is used only for power and reference voltage for the ADC 0817, and supplies only 1 mA.

IC2, IC6 and IC7 form a series of one-shots and flip-flops which start the conversion process, give a busy signal which can be used to prevent further data coming in during the conversion, set the address latch, and which are reset by the end-of-conversion pulse.

IC1, IC3 and IC4 sense that a data conversion is required, either by the computer or by the incoming data, and set the address latch onto the ADC so that the correct analog input may be used. Inputs 8–14 may be accessed by the experiment directly, while inputs 0–14 may be accessed by the computer. IC2 starts the conversion process whenever a high-to-low transition is seen at any of its inputs, assuming that all were high to begin with. The 2N2222 transistors on the inputs of IC1 are invert-buffers. In my applications, the "data present" strobe is usually + 10 V, and these invert the signal and convert it to TTL levels. IC1 is a priority encod-

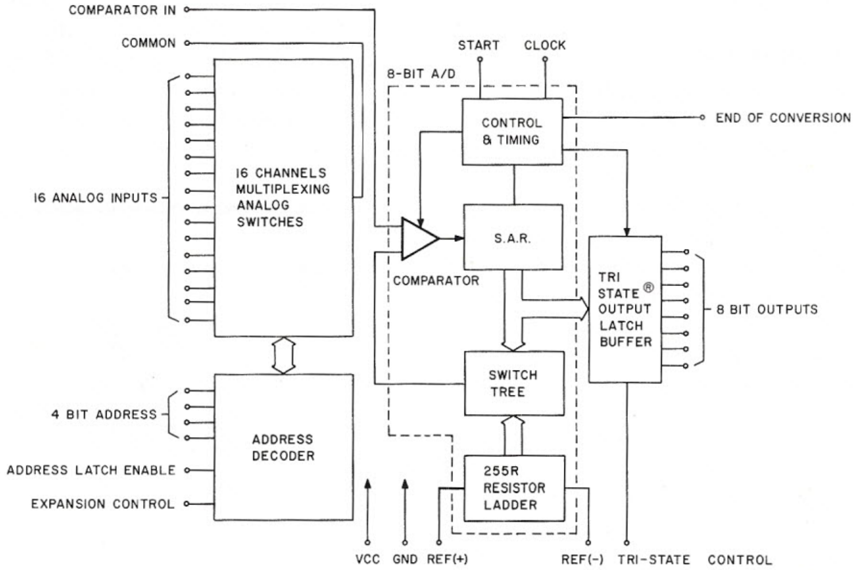


Fig. 4. Block diagram of the ADC0817 (courtesy National Semiconductor).

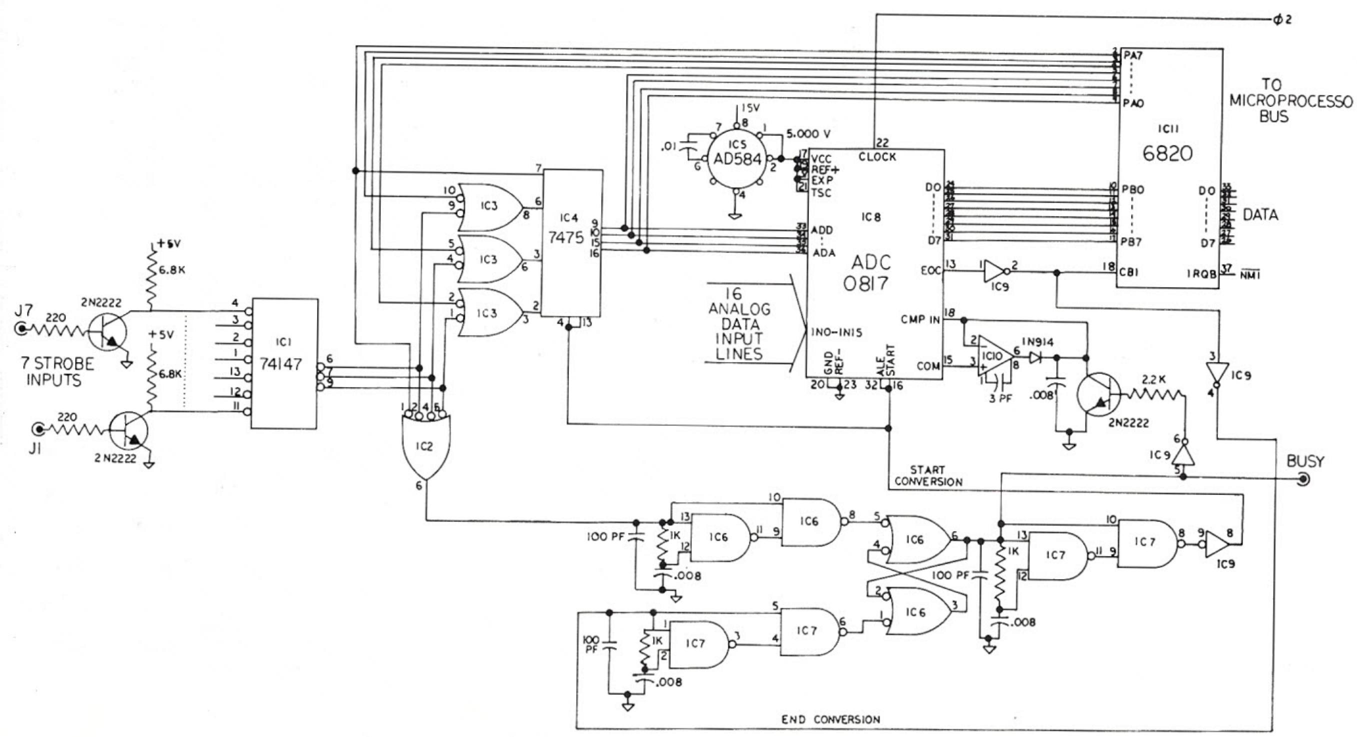


Fig. 5. Circuit diagram of ADC0817 in use in present work.

er so that J1 has highest priority; the most important signals should go onto J1. If a signal is present at J2, and a signal comes into J1, the conversion will switch to J1.

A four-bit code is sent to the processor via the lowest four bits of the A-side of the 6820 PIA to tell the computer which input of the ADC is being converted. This is necessary for one of the strobed inputs, and is a good confirmation that the correct computer-controlled input is being accessed. To access an input, simply output the four-bit address of the input channel through the higher four bits of the A-side of the PIA.

Notice that we are using the PIA as 12 inputs and four outputs. The 6820 is designed so that all bits of either side can be programmed by the computer to be either input or output. In this case, the B-side is all input, while the A-side is half input and half output.

Users of SS-50 systems who have the MP-LA parallel input/output card must make a minor change in the card. This card is set up so that all of the B-side is input and all of the A-side is output. Cutting two tracks and adding two wires, as shown in Fig. 6, will reverse the buffers on the lowest four bits of the A-side and make those four bits inputs. A DPDT switch can be glued to the card to switch back and forth.

Lastly, the converter is dependent upon a high-frequency square wave clock, which is to be input to pin 22 of the ADC 0817. This clock should be between 600 kHz and 1200 kHz. In my SWTP 6800 system, I simply use the 875 kHz Ø1 clock line.

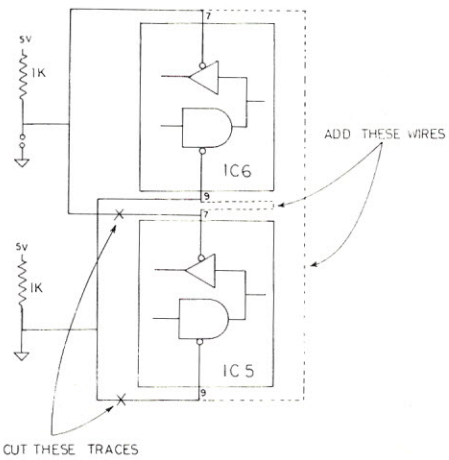


Fig. 6. Modifications to the MP-LA output port.

See List of Advertisers on page 210

Since the converter is designed to digitize data which arrives at random, unpredictable times, the converter has been set up to cause an interrupt in the processor. In the case of a 6800-based machine, this should be a nonmaskable interrupt (NMI). The output of pin 37 of the PIA should be tied to the NMI line of the processor bus.

ADC Programs

The software used with the converter should reflect the 15-input nature of the converter, and should also be able to be used as an interrupt service routine, since the end-of-conversion signal causes an interrupt. An example of the type of software to be used in 6800-based systems is given in Listing 1.

This software is in two major parts: Routine CALDAT at $DA00 is a subroutine which puts out a number between 0 and 14 from accumulator A to begin a conversion on data lines 0 to 14. The routine starts the conversion, waits for the data, services the interrupt, and returns to the calling program. The other routine, DATAIN at $DA46, is the interrupt service routine. The routine accepts the data from the PIA, gets the address of the input channel in box, and branches to one of 15 service routines to store the data or operate on it. A different routine is provided for each of the 15 usable channels, since the usual procedure will be that each channel means something different.

An example of such a service routine is given in Listing 2. In this case, a histogram is generated, to give the number of times a specific voltage is seen versus the voltage itself. If the voltage measured corresponds to, for example, the energy of an X-ray, then the histogram is a plot of the number of X-rays seen *vs* energy of X-rays. Such a histogram is plotted in Fig. 7.

If you use the program above, or a similar program, with your machine, be sure that the nonmaskable interrupt vector is programmed to transfer control to the interrupt service routine DATAIN.

IC No.	Type	+5 V Power	Ground	+15	−15
1	74147	16	8		
2	7420	14	7		
3	7400	14	7		
4	7475	5	12		
5	AD584	—	4	8	
6	7400	14	7		
7	7400	14	7		
8	ADC0817	—*	20,23		
9	7404	14	7		
10	LM310A	—	—	7	4
11	MC6820	20	1		

*See Text

Table 1. Power and ground connections for integrated circuits.

The programs above are not relocatable nor re-entrant, and may not be placed in EPROM, since they are self-modifying. It would have been easy to write the routines to meet these criteria, but speed of execution would have suffered greatly. Since my uses require up to 1000 conversions per second, the speed of the service routine is paramount, or data will be lost. The creative programmer with less stringent requirements can easily rewrite the programs to his own needs.

No matter what your analog-to-digital conversion needs, this circuit can solve them for you, with a minimum of cost, parts count and programming.■

```
HISTO
SSB MNEMONIC ASSEMBLER  PAGE 1

                  NAM   HISTO
                  OPT   NOP
              *
              *INTERRUPT SERVICE ROUTINE
              *TO CREATE HISTOGRAM
              *OF FREQUENCY VS CHANNEL
              *
D900              ORG   $D900
              *
D800          HISTGM EQU   $D800
8018          PIAADC EQU   $8018
              *
D900 B6 801A      LDA A PIAADC+2
D903 B7 D90A      STA A JUMP+1
D906 FE D800      LDX   HISTGM
D909 6C 00    JUMP INC   0,X
D90B 39           RTS
              *
                  END
    NO ERROR(S) DETECTED
```

Listing 2.

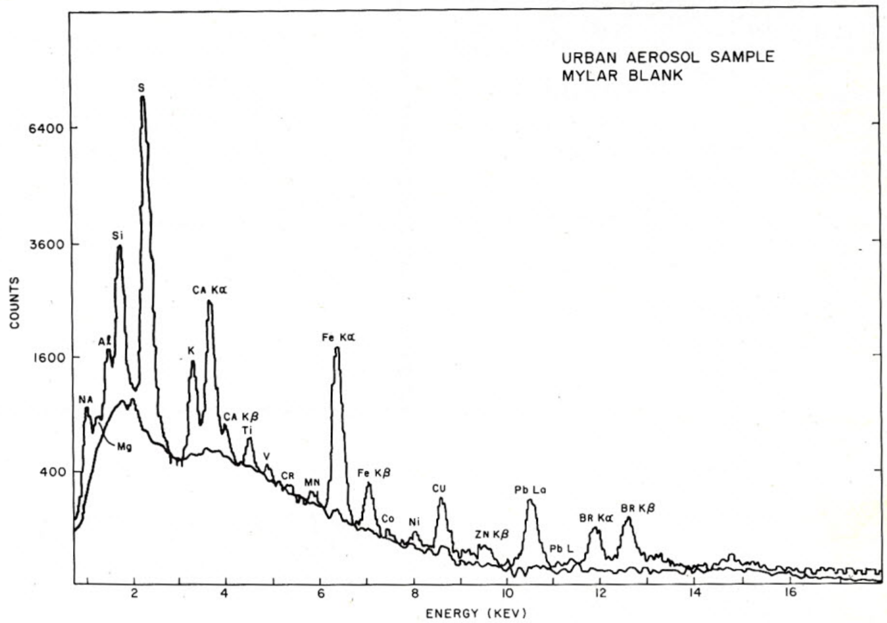


Fig. 7. Histogram of frequency of occurrence of a given value of the ADC data vs the value of the data. To be specific, in this case, X-ray intensity vs X-ray energy. Notice the peaks showing up nicely, corresponding to characteristic X-rays of a given element.

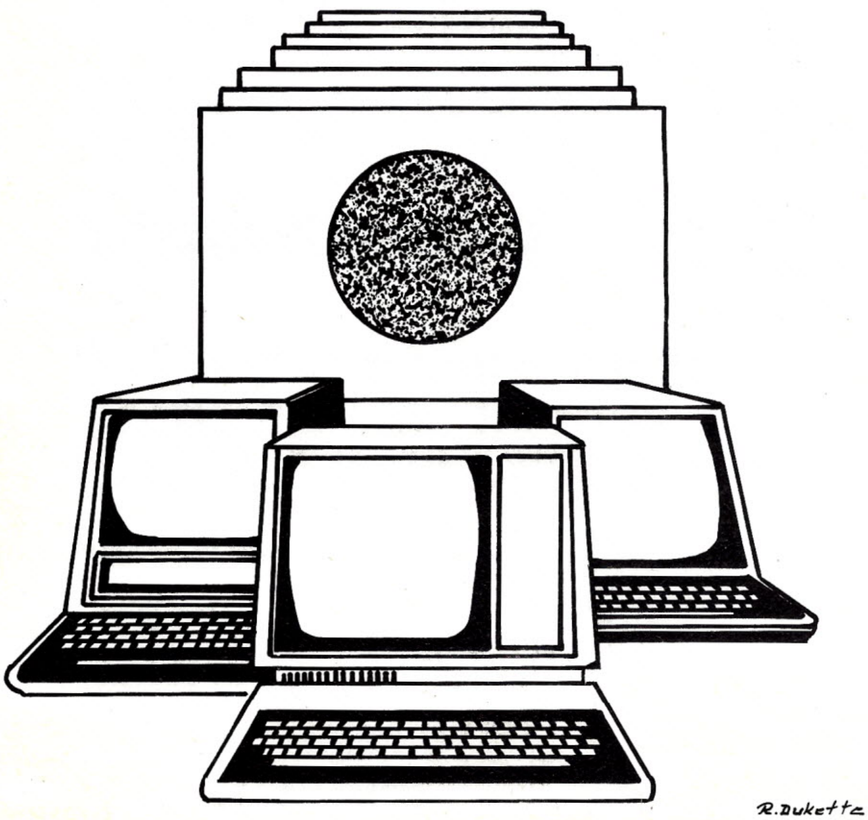
This series' concluding article puts into perspective the growing Japanese presence in the microcomputing marketplace and its effect on the American consumer.

Japanese Invasion: Part IV

By G. Michael Vose

It does not now appear that the Japanese are going to flood the small computer market with awesome machines priced like fast food—at least not for a year or more. The computers reviewed in Parts I, II and III of this series (the Casio FX-9000P, September, p. 101; the Sharp YX-3200, October, p. 90; and the NEC PC-8000, November, p. 110) are expertly designed and well-made but are not appreciably better than homegrown machines. And while they are competitively priced, they do not significantly undercut the prices of American manufacturers. So how do we evaluate the invasion we speak of in the title of this series?

Ultimately, the Japanese may overwhelm the American market by sheer number—number of manufacturers and number of machines. The Japanese, in spite of the seeming socialistic benevolence of their industrial organizations, are fiercely competitive. This is true of the worldwide marketplace, but it is especially true in Japan. While most Japanese companies would like to be among the top companies in the world, they would like even more to be number one in Japan. This competitiveness, combined with Japanese electronic expertise, will guarantee that the peoples of this small Far Eastern island will be responsible for significant advances in computer technology.



Many Little Companies All in a Row

Our series so far has looked at new computers from three of Japan's most aggressive electronics conglomerates. A survey of the industry in Japan reveals, however, that no fewer than 25 companies are manufacturing and selling micro- and minicomputers. Several of these firms also market mainframe computers. These machines cover the gamut from a unit with a 4K byte user memory and a Z-80A CPU to units with a

G. Michael Vose is a technical editor for Microcomputing.

256K byte user memory accessed by a 16-bit Intel 8086 processor. In-between are units with twin 6809 CPUs to computers designed around the Motorola 68000 processor that can function in either a 16-bit or a 32-bit environment.

Interestingly, the Japanese have never used the 6502 CPU in mass-marketed machines. The Motorola, Intel and Zilog microprocessors have been the building blocks for Japanese engineers.

The names of many of the Japanese companies now making microcomputers—Canon, Casio, Hitachi, NEC, Sanyo, Seiko, Sharp, Toshiba—are familiar to both Americans and Europeans. Others such as Oki, SORD, Anritsu and Densan are less familiar. They all have a common thread, however—a history of manufacturing success and some experience with electronics. This is in direct contrast with the American method of building hardware.

In the U.S., a new hardware idea usually means a new company. A new company very often is started by an engineer with a great new idea, very often with a prototype of the hardware system he has designed. The engineer usually doesn't know much about marketing, manufacturing, organization and the other components of business operation. Unless he can find and afford competent, knowledgeable managers, his project may never succeed. The idea may eventually catch on, but often the engineer who developed it loses out.

In Japan, the engineer is committed to the company he works for. A great new idea makes the company look good and, as a result, many people benefit. The manufacturing and marketing support are in place to assure the successful implementation of the technology. The risks are shared as well as the rewards.

In America, established electronics firms such as RCA, Sylvania and Magnavox have made no attempt to develop new technology like computers. Even Radio Shack, the electronics firm that made available the first low-priced, mass-marketed microcomputer, took on the new project with skepticism and with no expectation of success. Radio Shack did not commission the development of the first TRS-80: it merely bought the idea after the fact. Zenith Corporation acquired Heath Company after its computer had been developed—this deal was struck more for economic reasons than any other.

What does this mean to the long-range future of the microcomputer market and the Japanese role in it? The Japanese have demonstrated that they have the expertise to make a quality small computer. In just the four years since the Apple and TRS-80 were developed, the Japanese have developed the Sharp Business Computer and the NEC PC-8000. These machines are just as good as their American counterparts and only slightly more expensive.

The Japanese have heard the cry, "What about software?" and are striking deals with software companies and making machines that are compatible with existing operating systems and software libraries. The Japanese are skilled in marketing concepts. (For example, NEC has just announced that its new PC-8000 system will be sold by the new Sears Business Systems Centers, which began opening around the country in October.)

The Japanese are capable, competitive and have a strong industrial base. They will obtain a share of the market and will develop new and better machines.

The Invasion Continues

Ironically, the rapidly growing Japanese presence in the microcomputer marketplace has the effect of confusing an already blurred landscape. The prospective buyer of computer equipment, whether a businessman or a home-computer buyer, must wade through an expanding selection of units, all claiming to be the best. Ten years from now, the chore will be easier because many shoppers will know what they want or need and will be able to narrow the field before they start. But today, many people know that they want or need a computer, but they are not sure why.

And the selection grows. Sharp Corp., in addition to its YX-3200 Business Computer, markets the MZ80B in Europe. Oki Corp. sells the IF800 (Models 10, 20), a Z-80 based machine with 48K bytes of user memory, 8K bytes of prepro-

grammed systems memory and graphics with color capability. Matsushita Company offers the Mybrain 850M monochrome display computer operating with an 8085 (eight-bit) processor and featuring 56K bytes of user memory.

Densan Co. Ltd. makes available a terminal-dependent unit called the DSC-80ZA, containing a Z-80A or 8088 (eight-bit) processor. Canon offers a pair of 6809-based machines, the BX-3 and CX-1, each with 32K bytes of user memory.

Other manufacturers now selling microcomputers only in Japan are eyeing the rapidly developing American market. TEAC sells a Z-80A-based, 48K byte monochrome display microcomputer; Hitachi offers a 6809-based color computer with 64K bytes of user memory for the equivalent of $1355; and Sanyo wants to become the OEM for any American firm interested in offering a 64K byte memory microcomputer fired by dual 8085A processors.

Most of the Japanese microcomputers contain a BASIC language interpreter and many offer optional packages to allow the use of COBOL, FORTRAN and Pascal. Many have operating systems similar to and compatible with CP/M. Most are S-100 bus constructed, assuring portability and compatibility with other computer systems.

The Japanese are diligent; they know what other people are doing and they are quick to adapt to what they see as a standard.

Who's the Best?

Is there someone who can tell you which computer is right for you? Only one—you! The name of the game is figuring out what you want to do, now and in the future, and then looking at machines and software that will do the job for you. Don't be afraid to be subjective—looks and ergonomics are as important as maxibytes and operating systems, color and graphics as important as price and serviceability. There seems to be no easy way to choose—it is helpful to learn as much as you can about machines with a big reputation (see the IBM and Xerox reviews elsewhere in this issue).

It is true that the computer you buy today will no doubt be dwarfed by the computers of tomorrow. But if today's computer does its job, it is nevertheless a valuable tool. The Japanese intend to see that you get a broad and capable choice.

The One Question

The Japanese do have one weakness that will affect their impact on the American market. They do not have the resources to produce innovative software for the U.S. consumer. The experience of VisiCalc and its effect on the sales of the Apple Computer, the first computer for which it was written, is a classic example of how top-quality software can boost hardware sales. While there is no way to evaluate this phenomenon, there is no question that software support helps to sell hardware.

If the Japanese can entice top software producers into writing for them, they will significantly enhance the market for their machines. Then it will be time to evaluate the Japanese Invasion, Phase Two.■

Does your SWTP need more room to move? The QRC motherboard is the solution to system expansion.

Relief for an Overstuffed SWTP

By Dennis Doonan

It was bound to happen. My SWTP 6800 chassis was filled. Even the eight I/O slots were filled with boards. While it is nice to have a full system, it is uncomfortable to know future expansion will cause drastic changes.

I could replace three memory cards with a single 32K card. This would open two main slots and ease the load on the power supply, but the cost of replacing three reliable products would be hard to justify.

Address correspondence to Dennis Doonan, c/o Graphics I, 345 Main St., Racine, WI 53403.

The only sensible alternative was to expand the motherboard. The procedure is described in the SWTP system manual; just buy another motherboard and connect it in parallel with the existing one.

This sounds simple, but there are two problems. SWTP no longer makes the MP-B2 motherboard. Even if a used one could be found, it would have the same I/O addresses as the first one. Rewiring would be necessary. See the April 1980 issue of *Microcomputing* ("The SWTP Computer System," p. 136) for an explanation of the re-addressing procedure.

The decoding on both boards would also have to be changed or a full 8K of address space would be needed for the I/O ports. This couldn't even be considered on a system limited to 64K.

About the time I was faced with these problems, Quality Research Company (PO Box 7207, Spokane, WA 99207) announced their 80-210 motherboard for the SS-50 bus. It was designed with expansion capability in mind.

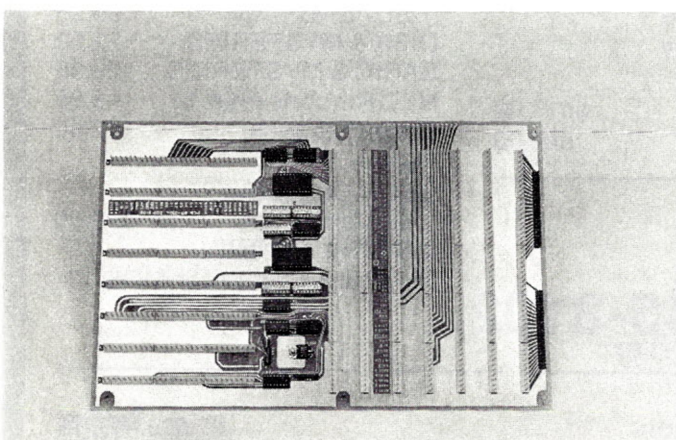


Photo 1. The completed QRC 80-210 motherboard. It can be used as is for a single system or used as an expansion motherboard.

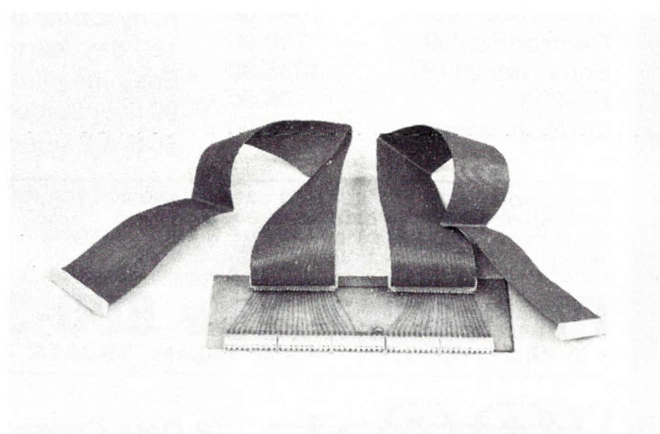


Photo 2. The extender card that fits onto the existing SWTP chassis. The two ribbon cables go to the QRC extension board. This is the back view of the board.

The Package

The QRC 80-210 is a double-sided, plated-through board physically compatible with the SWTP motherboard. It provides seven main 50-pin slots and eight fully decoded 30-pin I/O slots. All of the data, address and control lines have interbus shielding and buffering. There is even ground plane shielding on the top of the board. These shields provide the lower signal noise level essential for expansion.

The price of the 80-210 bareboard is a reasonable $39.50. QRC provides the pin connectors for an additional $20.

The QRC documentation is clear and concise. It gives assembly instructions, a parts layout, schematic and theory of operation.

Connection

Assembly takes about one hour, but care should be used to keep the pin connectors straight when soldering. If they are installed at an angle, it is difficult to insert boards. It is best to solder each end of the individual 10-pin connectors and make sure they are straight before soldering the rest of the pins.

The board is delivered with the I/O addressed at 8000 (hex). Since the eight four-byte I/O ports are fully decoded, they use only 32 bytes of the memory map and can be addressed to any location.

The I/O address decoding can be selected by jumpers or DIP switches. The switches allow easy reconfiguration if a 6809 processor card is ever installed.

The I/O ports on the SWTP 6800/2 use partial decoding. The 32-byte address pattern is repeated after 32 bytes of free address space for the entire 4K block. The easiest way to use the QRC board is to address its I/O at $8020 so it fits between the addresses used by the SWTP motherboard. There are now 16 I/O ports available on the system.

Ports zero through seven can be used without modifying existing software. If the other eight ports are needed by a high-level language such as BASIC, they can be called from a machine-language routine (the user function in BASIC).

The 50-pin bus of the 80-210 is expandable through two 50-pin standard connectors (AMP 2-87227-5) on the front edge of the board. Two 50-wire ribbon cables go to the second motherboard. While SWTP recommends #18 wire for the extension, ribbon cables will be adequate if they are kept short.

The only problem remaining is to connect the cable to the SWTP motherboard. The wires can be soldered directly to the original motherboard, but it is easier to use a short extender card ending in an AMP connector matching the ones on the QRC board. Fig. 1 is a full-size etch guide for the extender. Conventional Molex connectors are used at the bottom and two AMP pin connectors are used at the top. The +8 V line is not connected. A jumper may be installed if needed.

If your original power supply is not overloaded, it can power the expansion motherboard. Power and control lines are brought to the side of the

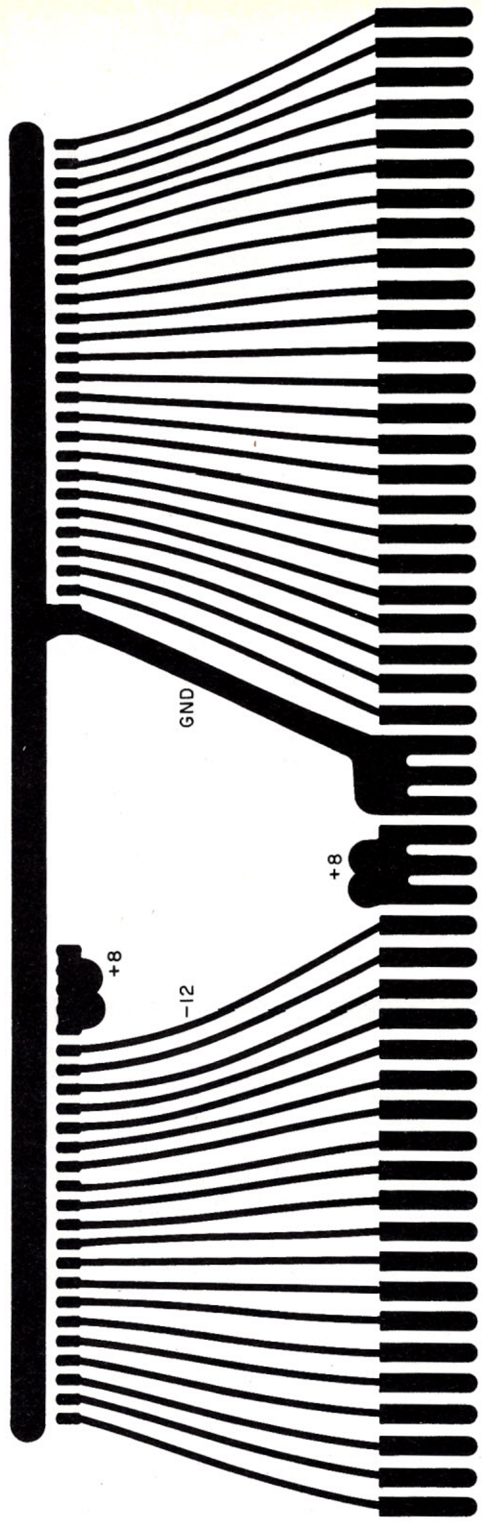
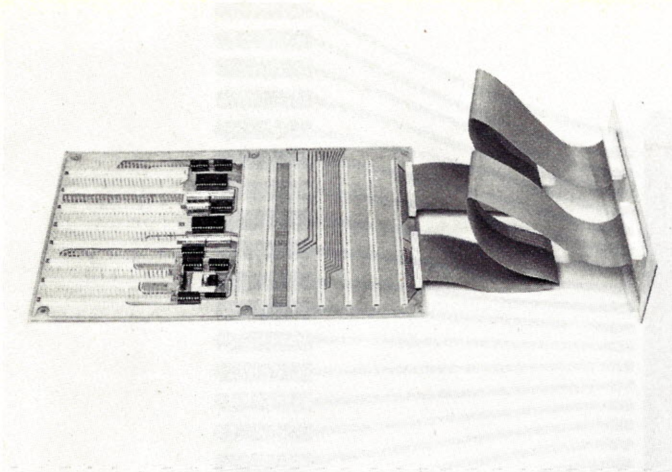


Fig. 1. This is a full-sized etch guide that can be used for etching the extender card. The center points for drilling are not included on this layout.



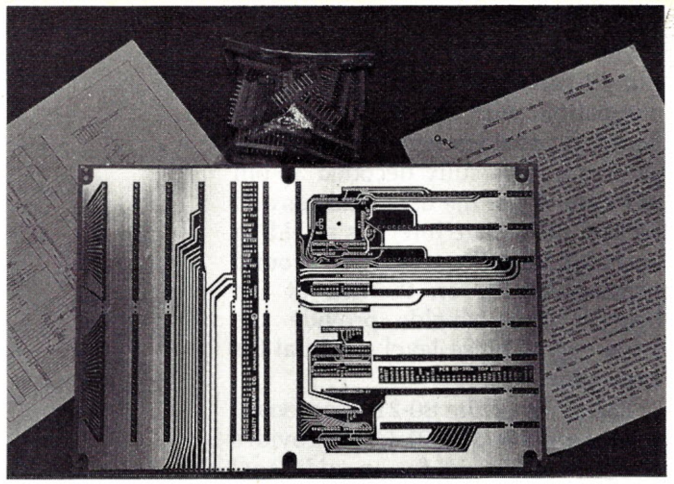


Photo 3. This is the unpopulated QRC motherboard and extension cable/extender card ready to plug into the SWTP.

Photo 4. The QRC motherboard as it arrived with bare board documentation and pin connectors.

QRC board. The power supply should be connected directly to these points rather than through the extension cables.

If your system's power supply is weak, a second supply can be connected to the expansion motherboard. If this is done, cut the + 12 and − 12 V traces on the extender board. Be sure the ground leads are connected between the two boards.

When using the ribbon cables, be sure the connectors are seated properly to ensure a tight fit. Also, before applying power, be certain the connection between the two boards is correct. If either the extender or the cables are inserted incorrectly, a great deal of damage could be done. This caution is necessary since the extender card was designed to have the foil traces on the top of the board. This allows more room in the chassis.

The expansion is definitely worth the trouble. It is now possible to use old 4K memory boards and address them to unused areas such as 9000. I/O boards and custom interfaces can be added without removing existing boards. The Quality Research Company's 80-210 has proved to be a reliable, reasonably priced solution to system expansion.■

Send Your Business To Europe via Wayne Green International

You can introduce your products to the European market without leaving your office. All you need is a phone and the best advertising liason between here and Europe—Wayne Green International. We represent four of the largest microcomputing magazines in Europe that will help you introduce and make your product known in the European market.

MICRO DIGEST

MICRO DIGEST is the newest resource for American businessmen to rely on for the best exposure overseas. The first dealer-oriented computing publication in Europe, MICRO DIGEST caters to dealers, reps, OEMs and importers of micro and mini products. MD is the organ of the European Microcomputer Publishers Association (EMPA). It is published in four editions (English, French, German and Italian), reaching a market of 312 million people. As the publishers of West Germany's CHIP and several other popular computing periodicals, EMPA is in the best position to determine the make-up of the computerist market. The list of people receiving MICRO DIGEST has been put together by EMPA. As a result, MD's present circulation of 8000 reaches the most prominent computerist community in Europe—a community that's waiting to hear from American businessmen. Make MICRO DIGEST your best ally in the European micro market.

Special 10% discount to charter advertisers

CHIP

The German-speaking market has an exceptional sales potential. CHIP, the leading German magazine for desktop computers, will help you to make this market your own. Over 65% of the CHIP readership deals with computers in their business or profession. With its reputation for excellence and a paid circulation of 62,913*, CHIP is your direct line to the German microcomputer market.

*IVW Auditing (ABC Equivalent), 2nd quarter, 1981

COMPUTING TODAY

Britain's COMPUTING TODAY offers the advertiser a well-balanced publication with very competitive rates and a rapidly rising paid circulation of 34,000. COMPUTING TODAY is the only microcomputing magazine in England audited by ABC. It provides solid penetration across the entire microcomputing market and is an effective sales medium for hardware, software, peripherals and publications. Whatever your product range, there is simply no better way to build microcomputing business than through the pages of COMPUTING TODAY.

MICRO & PERSONAL COMPUTER

MICRO & PERSONAL COMPUTER is the ideal media for introducing and marketing computer products in the Italian market today. With a monthly circulation of 30,000 M&PC is in the hands of virtually everyone involved with computing in Italy. In the last two years, the Italian economy has grown, in real terms, by a 10% rate—a growth rate second only to Japan's. The total EDP market in Italy in 1981 has totalled 5,000 million dollars. It is this level of trade that is waiting to be taken advantage of. It can be yours, with the help of MICRO & PERSONAL COMPUTER.

TO RECEIVE FURTHER INFORMATION ON THESE MAGAZINES, WRITE OR CALL:

Piergiorgio Saluti
Wayne Green International ✓410
Peterborough, New Hampshire 03458
(603) 924-7138 Dept.—A74

✓See List of Advertisers on page 210

Z-charting helps businessmen evaluate the performance of their business by studying the shape of their Z. Programmers will find this method of manipulating data arrays intriguing.

In Search of the Perfect Z

By Gene Embry

The Z-charting technique for evaluating the performance of a business is rather obscure. But once you understand Z-charts, a quick glance will reveal several basic facts about the performance of a company. Programmers will find it an intriguing method of manipulating data arrays.

Fig. 1 shows a Z-chart. The vertical axis is labeled Dollars and the horizontal axis is Time. The bottom horizontal bar of the Z is a plot of the planned monthly bookings. The top bar of the Z shows the accumulated bookings for the past 11 months plus this month's bookings. The diagonal shown as the dashed line represents the year-to-date (YTD) planned bookings. The diagonal shown by the solid line represents the YTD bookings. In the very unusual case where bookings are equal to the plan, then only one line would be shown for the diagonal.

A programmer might think of the Z-chart as a 4 × 12 data array—12 data points for each part of the Z-chart. For each month there may be up to four different data points.

The interpretation of the Z-chart deals with the shape and not with the absolute values. Consider the four cases that are shown in Fig. 2. The first Z-chart, Fig. 2a, represents a no-growth company where the monthly plan and monthly bookings are the same, year after year. Fig. 2b shows a growing company with a monthly increase of about 5 percent and with monthly bookings equal to the plan. The third, Fig. 2c, shows a company with a planned declining situation. This might represent a planned withdrawal from a marketplace. The final example, Fig. 2d, shows a situation where bookings are lagging the plan by about 50 percent, a very unhealthy situation. The demise of this company is near. (These four cases should serve only to introduce you to Z-charts, and not all possible situations.)

The business with a perfectly shaped Z, Fig. 2a, would not be given a perfect 10 by those with business acumen. But today's managers generally stress growth while maximizing gross return on net investment (GRONI). Current business theories are generally based on a time when our society was primarily oriented toward manufacturing. Within the last two or three years, we've become mainly service-oriented. Could it be that yesterday's theories are only partially correct? A normal Z (Fig. 2a) may, in fact, be a reasonable and desirable goal. If you can take $100,000 out of your business, year after year, and you are satisfied, why shouldn't that business be considered healthy?

Note the positive slopes in Fig. 2b for the growth company and the negative slopes for the declining business in Fig. 2c. Fig. 2d shows convergence of the two bars, indicating aggressive planning but declining bookings.

These four examples show that several important aspects of a business may readily be attained from a Z-chart. Two items not initially apparent from the Z-chart are the increased need for cash when the bookings begin to outstrip the plan, and the need to replace the planners or salesmen when bookings lag the plan by some unacceptable amount.

You don't need to restrict the vertical axis to dollars. It might be anything that is important to your business; e.g., the number of pages of advertisements in a magazine or productivity (dollars invoice per employee) time.

The program, ZCHART.BAS (Listing 1), can do much more than plot a Z-chart. It will let you start your own company and insert your own monthly plan and bookings for a 20-year period. You can automatically generate 20 years of data based on random numbers. You can list the entire 20 years of data or just one year's data. Further, you may save the data on disk or retrieve it from disk.

I've written the program in a modular form so that you can select only those portions you want to use. If you don't have a disk, you can insert a subroutine, starting at line 5000, to get your data from magnetic tape or from data statements.

Each of the seven main subroutines begins on a line number that is an in-

Address correspondence to Gene Embry, Route 1, Box 151-H, Morrisville, NC 27560.

teger of 1000 and returns on a line number that is an integer of 1000 plus 90. I'll first discuss the program initialization process and the generation of the main menu section, and then describe each of the seven major subroutines. The program is fairly well documented with remark statements, so I'll only describe certain items in the program that are interesting or a bit unusual.

Initialization

The program variables are initialized by the call to routine 9800. The main function of this routine is to dimension the arrays and assign certain variables. A listing of the major arrays and variables are shown in Table 1.

During this section, you are prompted to input the y-axis resolution. Your answer to this question determines the size of the plotting array, Z(R,12). Since the program provides for automatic scaling of the y-axis, your answer will, in effect, determine the length of the y-axis. If you exceed the size of your read/write memory, then the error trapping section, line 9990, will be invoked.

The main menu is displayed via lines 100 to 140. Your selection is requested and the particular subroutine is called from lines 170 to 199.

MAKE DATA—1000. If you elect to generate some random data, this section is called. We give a "seed" of $10,000 to the company in line 1004 to start off the generation of the 20 years of planning and bookings. Each month's plan is based on the past month's bookings within the limits established by line 1110. This gives a probability of a 6 percent decrease or a 14 percent increase in next month's plan. The bookings for a month are based on the plan for the current month. As shown in line 1210, the probability of increased bookings is 15 percent and 5 percent probability for decreased bookings. This process ends in one of two ways. If you successfully generate 20 years of data, then you return. If you try to divide

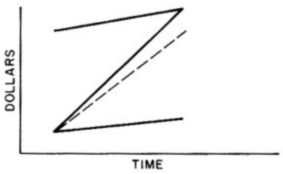


Fig. 1. The Z-chart defined.

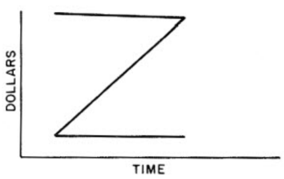


Fig. 2a. Z-chart for a no-growth company.

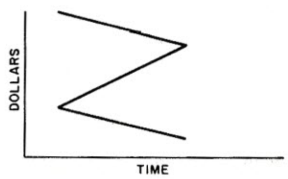


Fig. 2b. Z-chart for a 5 percent per month growth company.

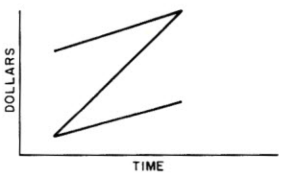


Fig. 2c. Z-chart for a planned withdrawal.

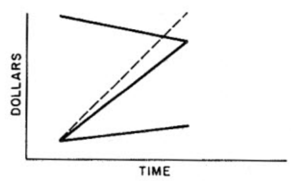


Fig. 2d. Z-chart for an unplanned withdrawal.

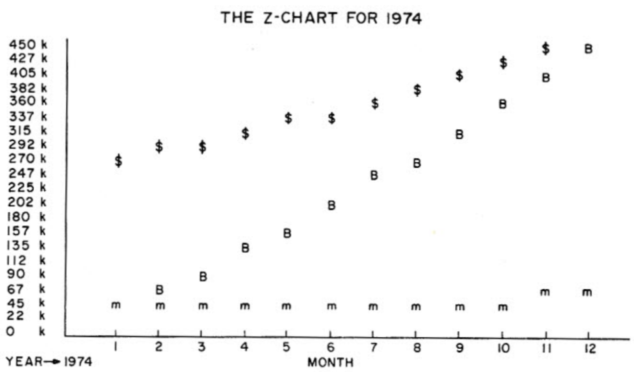


Fig. 3. Z-chart for a very good year.

✓See List of Advertisers on page 210

by zero, then you call the error trapping and report that the company went bankrupt. During this process you will also be filling your data array, S(120,3).

PLOT Z-CHART—2000. This is the most difficult part of the program and the section that may deserve special attention, if you find that fooling around with arrays is a fun way to spend a couple of hours.

After verifying that a proper year has been selected (2000–2023), you back up 11 months and get the sum of the bookings during that period (2028–2038). The code from 2040 to 2070 is a major FOR-NEXT loop that sets the proper data from array S(X,3) and makes the necessary additions and subtractions to the array G(4,N).

To do the automatic scaling of the y-axis, the maximum value is determined in lines 2066 to 2068. After array G(4,N) has been filled, you call routine 2100, which does the automatic scaling of the y-axis based on the size of R in the array Z(R,C). This is done in lines 2106 to 2114. The assignment of the value for Z(R,C) is done in line 2140. Note that this is third-level nesting—for each unit of the y-axis, for each month and for each of the four possible values in G(4,N).

Finally, the call is made to routine 2200, which does the printing of the Z-chart.

Figs. 3 and 4 show sample runs for the years 1974 and 1978 using the data from Table 2. The symbol B represents the YTD bookings, and P is the YTD plan. A lowercase m represents the monthly planned bookings,

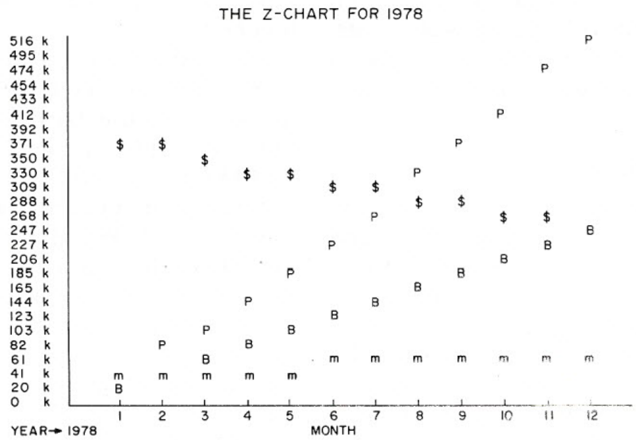


Fig. 4. Z-chart for a very bad year.

Variable	Description
C1	Number of items in main menu
F	Used as scaling factor
F1	Flag used during display of main menu
G(4 12)	Temporary storage array
M	Local variable usually represents the month
M$	Title of this program
Q	Output port for listing and displays
Q1	Selecting from the main menu
R1	Vertical resolution of y-axis of z-chart
S(240 3)	Array of time-plan-bookings
S$	Subtitle for main menu
Y1	First year of data
Y2	Last year of data
Z)R1 12)	Array for plotting the z-chart
Z$	File name of stored data

Table 1. Major variables used in ZCHART.BAS.

Entire data file
PLAN/BOOKINGS

Months -->

Year	1	2	3	4	5	6	7	8	9	10	11	12
71	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15
72	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15	15/15
73	16/16	17/17	17/17	18/18	19/19	20/20	21/21	22/22	23/23	24/24	26/26	27/27
74	28/28	30/30	31/31	33/33	34/34	36/36	38/38	40/40	42/42	44/44	46/46	48/48
75	48/48	46/46	44/44	42/42	40/40	38/38	36/36	34/34	33/33	31/31	30/30	28/28
76	27/27	26/26	24/24	23/23	22/22	21/21	20/20	19/19	18/18	17/17	17/17	16/16
77	16/32	16/32	16/32	16/32	16/32	16/32	16/32	16/32	16/32	16/32	16/32	16/32
78	32/16	34/18	36/18	38/19	40/20	42/20	44/21	46/21	48/22	50/22	52/23	54/24
79	28/25	28/30	25/28	32/30	33/35	31/29	35/33	34/39	36/25	35/20	35/25	30/25
80	32/48	44/56	70/52	38/28	50/34	78/51	43/41	56/5	87/87	41/41	54/54	82/82
81	46/47	45/48	45/49	42/42	47/54	45/51	46/48	47/46	49/54	51/48	51/48	51/50
82	52/52	50/56	54/61	56/59	58/58	61/61	66/71	67/68	73/71	83/94	89/92	93/93
83	71/75	71/77	73/81	82/88	80/81	84/88	86/92	80/85	80/83	81/78	77/84	74/84
84	83/88	91/97	100/113	97/96	101/100	113/110	110/111	115/116	124/133	117/122	132/139	133/147
85	123/129	119/121	129/144	141/137	136/130	155/152	154/160	166/178	159/161	166/162	165/162	169/167
86	157/157	176/187	189/205	198/211	220/213	225/235	255/289	261/276	270/304	264/284	261/298	284/277
87	231/220	248/254	239/273	267/268	258/245	279/310	292/296	304/299	304/318	286/307	275/309	263/284
88	29/30	32/34	36/36	38/40	41/44	39/39	43/46	45/50	50/53	50/57	45/50	50/60
89	40/50	46/51	45/46	50/51	51/49	52/52	55/61	53/61	56/62	57/57	60/60	67/76
90	64/64	67/75	75/80	85/94	85/91	92/89	93/104	102/98	110/118	110/117	118/119	115/124

Table 2. Twenty years of data.

☆☆

4MHZ, DOUBLE DENSITY, COLOR & B/W GRAPHICS . . THE LNW80 COMPUTER

When you've compared the features of an LNW80 Computer, you'll quickly understand why the LNW80 is the ultimate TRS80 software compatible system. LNW RESEARCH offers the most complete microcomputer system at an outstanding low price.
We back up our product with an unconventional 6 month warranty and a 10 days full refund policy, less shipping charges.

LNW80 Computer $1,450.00
LNW80 Computer w/B&W Monitor & one 5" Drive $1,914.00
All orders must be prepaid, CA residents please include 6% sales tax.
Contact us for shipping charges

* TRS80 Product of Tandy Corporation.
** PMC Product of Personal Microcomputer, Inc.

COMPARE THE FEATURES AND PERFORMANCE

FEATURES	LNW80	PMC-80**	TRS-80* MODEL III
PROCESSOR	4.0 MHZ	1,8 MHZ	2.0 MHZ
LEVEL II BASIC INTERP.	YES	YES	LEVEL III BASIC
TRS80 MODEL 1 LEVEL II COMPATIBLE	YES	YES	NO
48K BYTES RAM	YES	YES	YES
CASSETTE BAUD RATE	500/1000	500	500/1500
FLOPPY DISK CONTROLLER	SINGLE/ DOUBLE	SINGLE	SINGLE/ DOUBLE
SERIAL RS232 PORT	YES	YES	YES
PRINTER PORT	YES	YES	YES
REAL TIME CLOCK	YES	YES	YES
24 X 80 CHARACTERS	YES	NO	NO
VIDEO MONITOR	YES	YES	YES
UPPER AND LOWER CASE	YES	OPTIONAL	YES
REVERSE VIDEO	YES	NO	NO
KEYBOARD	63 KEY	53 KEY	53 KEY
NUMERIC KEY PAD	YES	NO	YES
B/W GRAPHICS, 128 X 48	YES	YES	YES
HI-RESOLUTION B/W GRAPHICS, 480 X 192	YES	NO	NO
HI-RESOLUTION COLOR GRAPHICS (NTSC), 128 X 192 IN 8 COLORS	YES	NO	NO
HI-RESOLUTION COLOR GRAPHICS (RGB), 384 X 192 IN 8 COLORS	OPTIONAL	NO	NO
WARRANTY	6 MONTHS	90 DAYS	90 DAYS
TOTAL SYSTEM PRICE	$1,914.00	$1,840.00	$2,187.00
LESS MONITOR AND DISK DRIVE	$1,450.00	$1,375.00	---

LNW80

- BARE PRINTED CIRCUIT BOARD & MANUAL $89.95

The LNW80 - A high-speed color computer totally compatible with the TRS-80*. The LNW80 gives you the edge in satisfying your computation needs in business, scientific and personal computation. With performance of 4 MHz, Z80A CPU, you'll achieve performance of over twice the processing speed of a TRS-80*. This means you'll get the performance that is comparable to the most expensive microcomputer with the compatibility to the world's most popular computer (TRS-80*) resulting in the widest software base.

FEATURES:
- TRS-80 Model 1 Level II Software Compatible
- High Resolution Graphics
  - RGB Output - 384 x 192 in 8 Colors
  - NTSC Video or RF MOD - 128 x 192 in 8 Colors
  - Black and White - 480 x 192
- 4 MHz CPU
- 500/1000 Baud Cassette
- Upper and Lower Case
- 16K Bytes RAM, 12K Bytes ROM
- Solder Masked and Silkscreened

LNW SYSTEM EXPANSION

- BARE PRINTED CIRCUIT BOARD AND MANUAL $69.95
WITH GOLD CONNECTORS $84.95

The System Expansion will allow you to expand your LNW80, TRS-80*, or PMC-80** to a complete computer system that is still totally software compatible with the TRS-80* Model 1 Level II.

FEATURES:
- 32K Bytes Memory
- 5" Floppy Controller
- Serial RS232 20ma I/O
- Parallel Printer
- Real Time Clock
- Screen Printer Bus
- On Board Power Supply
- Solder Masked and Silkscreened

LNW RESEARCH ✓198
C O R P O R A T I O N

2620 WALNUT
TUSTIN CA. 92680

ORDERS & INFO. NO. 714-544-5744
SERVICE NO. 714-641-8850

LNDoubler & DOS PLUS 3.3D

- Assembled and Tested W/DOS PLUS 3.3D. $175.00

Double-density disk storage for the LNW Research's "System Expansion" or the Tandy's "Expansion Interface". The LNDoubler™ is totally software compatible with any double density software generated for the Percom's Doubler***. The LNDoubler™ provides the following outstanding features.

- Store up to 350K bytes on a single 5" disk
- Single and double density data separation
- Precision write precompensation circuit
- Software switch between single and double density
- Easy plug in installation requiring no etch cuts, jumpers or soldering
- 35, 40, 77, 80 track 5" disk operation
- 120 day parts and labor Warranty

*** Doubler is a product of Percom Data Company, Inc.

DOS PLUS 3.3D

Micro Systems software's double density disk operating system. This operating system contains all the outstanding features of a well developed DOS, with ease in useability.

KEYBOARD

LNW80 KEYBOARD KIT $84.95

The Keyboard Kit contains a 63 key plus a 10 key, P.C. board, and remaining components.

CASE

LNW80 CASE $84.95

The streamline design of this metal case will house the LNW80, LWN System Expansion, LNW80 Keyboard, power supply and fan, LNDoubler™, or LNW Data Separator. This kit includes all the hardware to mount all of the above. Add $12.00 for shipping

PARTS AVAILABLE FROM LNW RESEARCH
- 4116 - 200ns RAM
  - 6 chip set $26.00
  - 8 chip set $33.50
  - 16 chip set $64.00
  - 24 chip set $94.00
  - 32 chip set $124.00
- LNW80 "Start up parts set" LNW80-1 . . . . $82.00
- LNW80 "Video parts set" LNW80-2 . . . . $31.00
- LNW80 Transformer LNW80-3 . . . . $18.00
- LNW80 Keyboard cable LNW80-4 . . . . $16.00
- 40 Pin computer to expansion cable $15.00
- System Expansion Transformer $19.00
- Floppy Controller (FD1771) and UART (TR1602) . . . $30.00

VISA MASTER CHARGE ACCEPTED   **UNLESS NOTED ADD $3 FOR SHIPPING**

✓See List of Advertisers on page 210

while $ is the sum of the last 12 months of bookings. Since the absolute variation in the monthly plan is generally small compared to the maximum value of the y-axis, the slope of the bottom bar of the Z may not always be apparent from the chart. In this case, you should check the values used to plot the chart.

SAVE DATA—3000. This section saves the array S(X,3) in a data file named Z$. First, it tests to see if the file exists (line 3010). If it does, it jumps to line 3020 and writes on top of existing data. If the file, Z$, does not exist, then it is created in line 3012. The element S(X,1) of each record is a composite number, with the first two digits equal to the year and the remaining digits equal to the month. The element S(X,2) represents the planned bookings and the last element stands for the bookings.

LIST TWENTY YEARS—4000. A complete printout of all 20 years of data may be obtained by calling this routine. If you display the data on your terminal, Q=1, then a slight pause follows each year's display, using the WAIT=3 statement in line 4040.

GET DATA FROM DISK—5000. This is the inverse of section 3000. You may need to rewrite for your particular system.

LIST ONE YEAR—6000. You are first prompted for the year to be displayed; a linear search is then made to find the first month of the year. If the search fails, then you report it and ask if another year is wanted. When the year is found, you determine where to print the data by calling routine 8000 to assign the port number, Q. The heading is printed via routine 8100. The data for the year is printed by routine 6100, which also makes a calculation of the ratio of bookings to plan.

CHANGE DATA—7000. If you want to change the data for a year, this section is called. You again find the year under consideration, and then for 12 months display the current plan and bookings. This permits you to change the data. The array S(X,3) is changed during the process. If you use this section you should remember to save the data in the file Z$.

Listing 2, ZLIST.BAS, is not a necessary part of the overall concept of Z-charting, but will prove useful as you generate your own data. The purpose of this program is to display a compact form of the 20 years of data contained in array S(N,3). Table 2 was printed using this program.

Future

You can improve this program in several ways. If you select a large value for the y-axis resolution, you may find that the time required to fill the array is excessive and will want to find a way to speed up this process.

The bottom-bar problem mentioned earlier might be solved using some sort of a software logarithmic amplifier, but I have no ideal way to use and merge it into this program.

This program restricts the Z-chart plotting from January to December. You might want to expand the program so that any month could be the starting month, since many companies start their fiscal year in July or September.

Conclusion

A friend introduced me to Z-charting about nine months ago. It has taken me that long to begin to understand the concept and work out the program. Z-charting may help the businessman to get a little better view of his business. For the programmer, I hope you have gained some insight into another technique of making a scaled data array from the raw data of another array.■

Listing 1. ZCHART.BAS.

```
0001 : ZCHART.BAS
0002 :
0003 : Gene Embry
0004 :
0010 ON ERROR GOTO 9990
0020 GOSUB 9800::   Program initialization
0099 :
0100 : Main
0101 :
0110 HOME
0112 LET DIGITS=0:RJUST=0
0120 PRINT TAB(W-LEN(M$)/2);M$:PRINT
0122 PRINT TAB(W-LEN(S$)/2);S$:PRINT
0124 PRINT "Y-axis resolution = ";R1;"units."
0128 PRINT
0130 FOR X=1 TO C1
0132 LET X$=STR$(X)+". "
0134 IF IMOD(X,2)=0 PRINT TAB(W);:F1=1
0136 PRINT X$;N$(X);
0138 IF F1=1 THEN PRINT:F1=0
0140 NEXT X
0170 SKIP 2
0180 INPUT "Make selection ",Q1
0190 IF Q1 < 1 THEN 100
0192 IF Q1 > C1 THEN 900
0194 GOSUB N(Q1)
0198 GOTO 100
0199 :
0900 : Done
0901 :
0910 PRINT
0920 PRINT "Bye!"
0990 END
0999 :
1000 : Make data
1001 :
1004 LET P=10:N=0::     We provide 'seed-money' of $10,000
1006 GOSUB 8000::Port
1010 FOR Y=Y1 TO Y2::    Years
1014 GOSUB 8100::Print heading
1020 FOR M=1 TO 12:: For 12 months
1022 GOSUB 1100::Get this month's plan
1024 GOSUB 1200::Get this month's bookings
1026 GOSUB 1300::Fill up the array
1042 PRINT #Q,M,
1048 DIGITS= 1
1050 PRINT #Q,P,S,(S/P)*100:: Ratio of monthly bookings to plan
1056 DIGITS= 0
1058 NEXT M
1060 DIGITS= 1
1062 LET V1=((S1-P1)/P1)*100::Ratio  of annual bookings to plan
1072 LET U$="==" : GOSUB 8200
1074 PRINT #Q,"Totals",P1,S1,V1
1076 DIGITS= 0
1078 LET P=S1/12:P1=0:S1=0
1080 PRINT #Q
1082 IF Y>=Y2 THEN 1088
1084 IF Q=1 WAIT 5
1086 NEXT Y
```

More

Listing continued.

```
1088 RJUST= 0:digits=0
1090 RETURN
1099 :
1100 : Get this month's plan
1101 :
1110 LET L=INT(P*.94):H=INT(P*1.14)::   See text
1120 LET P=((H-L+1)*RND+L):: This month's plan
1130 LET P=INT(P)
1140 LET P1=P1+P::Total of this years planned bookings
1190 RETURN
1199 :
1200 : Get this month's Bookings
1201 :
1210 LET L=INT(P*.95):H=INT(1.15*P)
1220 LET S=((H-L+1)*RND+L):: This month's bookings
1230 LET S=INT(S)
1240 LET S1=S1+S::This year's bookings
1290 RETURN
1299 :
1300 : Fill array S(240,3)
1301 :
1310 LET N=N+1
1320 LET T$=STR$(Y)+STR$(M)
1322 LET T=VAL(T$)
1330 LET S(N,1)=T::Year and month
1332 LET S(N,2)=P::Plan for this month
1334 LET S(N,3)=S::Bookings for this month
1390 RETURN
1399 :
2000 : Plot the z-chart
2001 :
2008 INPUT "Plot the z-chart for which year ",T
2010 IF T < Y1+1  PRINT "Year must be greater than ";Y1: GOTO 2000
2012 GOSUB 8000::port
2014 LET X$=STR$(T)+"1"::Find Jan.'s data for year, T
2016 FOR Y = 1 TO 240 STEP 12
2018 LET T$=STR$(S(Y,1))
2020 IF X$=T$ THEN 2028:: We found it
```

More

Listing continued.

```
2022 NEXT Y
2024 PRINT "Not on file":GOTO 2080::Failed to find the year
2028 PRINT "Working"
2030 LET Y3=Y-11:H=0:S=0:N=0::Y3 holds the position of 11 months ago
2032 FOR X = 1 TO 12 :FOR Z = 2 TO 3:G(Z,X)=0:NEXT Z:NEXT X
2034 FOR X = Y3 TO Y-1
2036 LET S = S + S(X,3)::Sum of last 11 months bookings
2038 NEXT X
2040 FOR X = Y TO Y+11
2046 LET S = S + S(X,3)::Add this months' bookings
2048 LET N = N + 1::Move to next months pointer
2050 LET G(1,N) = S::Keeps sum of 12 months of bookings
2052 LET G(2,N) = G(2,N) + S(X,2)::YTD total of years plan
2054 IF N>1 THEN G(2,N) = G(2,N)+G(2,N-1)::YTD total of bookings
2056 LET G(3,N) = G(3,N) + S(X,3)::YTD bookings
2058 LET G(4,N) = S(X,2)::Plan for this month
2060 IF N>1 THEN G(3,N) = G(3,N)+G(3,N-1)
2062 LET S = S - S(Y3,3)::Subtract 11th month old booking
2064 LET Y3 = Y3 + 1::move to next months bookings
2066 IF G(1,N) > H THEN H = G(1,N)::find the max. value
2067 IF G(2,N) > H THEN H = G(2,N)::find the max. value
2068 IF G(3,N) > H THEN H = G(3,N)::find the max. value
2070 NEXT X
2076 GOSUB 2100::fill Z() with proper values
2078 GOSUB 2200::print the array
2080 IF Q <> 1 THEN PRINT
2082 INPUT "Z-chart another year ",Q$
2086 IF Q$ = "y" THEN Q$="Y"
2088 IF Q$ = "Y" THEN 2000
2090 RETURN
2099 :
2100 : Fill up Z(R1,12) based on values in G(4,12)
2101 :
2105 PRINT "Filling the array: ";
2106 LET F = H/R1::Scaling factor
2110 FOR R = 1 TO R1::For each unit on the y-axis
2112 PRINT R;
2114 LET Z1 = H-((R-1)*F):Z2 = (H-(R*F))::Determines upper & lower limits
2120 FOR C = 1 TO 12:: For each month
2122 LET Z(R,C) = 0::Assume a space will be printed.See line #2230
2130 FOR X = 1 TO 4:: Assign the type of infomation
2140 IF G(X,C) <= Z1 IF G(X,C) > Z2 THEN Z(R,C) = X
2150 NEXT X
2160 NEXT C
2170 NEXT R
2190 RETURN
2199 :
2200 : Print the array after filling it
2201 :
2206 PRINT #Q
2208 PRINT #Q,TAB(30);"THE Z-CHART FOR ";:T$="19"+STR$(T):PRINT #Q,T$
2209 PRINT #Q
2210 FOR R = 1 TO R1
2212 LET Z1=H-((R-1)*F)::Scaled value for vertical axis
2214 PRINT #Q,INT(Z1);
2218 PRINT #Q,TAB(06);"k  | ";
2220 FOR C = 1 TO 12
2222 PRINT #Q,TAB(POS+4);::Position the printing head
2230 IF Z(R,C) = 0 THEN PRINT #Q," ";
2232 IF Z(R,C) = 1 THEN PRINT #Q,"$";::Sum of last 12 months bookings
2234 IF Z(R,C) = 2 THEN PRINT #Q,"P";::Sum of PLAN - YTD
2236 IF Z(R,C) = 3 THEN PRINT #Q,"B";::Sum of bookings - YTD
2238 IF Z(R,C) = 4 THEN PRINT #Q,"m";::Monthly plan for this year
2240 NEXT C
2242 PRINT #Q
2250 NEXT R
2280 PRINT #Q,"0";TAB(06);"k  |";
2282 FOR X = 1 TO 35:PRINT #Q,"__";:NEXT X:PRINT #Q
2284 FOR X = 1 TO 12
2286 PRINT #Q,TAB(X*5+10);X;
2288 NEXT X:PRINT #Q
2289 PRINT #Q,"Year -> ";T$;TAB(38);"Month"
2290 RETURN
2299 :
3000 : Save data
3001 :
3010 IF FCHK Z$<>5 THEN 3020::If Z$ exists then skip to #3020
3012 CREATE #10,Z$,240,36:: Otherwise create the file Z$
3014 CLOSE #10
3020 OPEN #10,Z$
3022 RECNO #10=1
3030 FOR X=1 TO 240
3032 IF S(X,1)=0 THEN 3080
3040 WRITE #10,S(X,1),S(X,2),S(X,3)
```

More

Listing continued.

```
3060 NEXT X
3080 CLOSE #10
3090 RETURN
3099 :
4000 : Print the complete array
4001 :
4010 GOSUB 8000::Which port
4020 LET Y=1
4022 GOSUB 8100::print heading
4030 GOSUB 6100::print this years data
4040 IF Q = 1 THEN WAIT 3
4080 LET Y = Y + 12
4082 IF Y < 241 THEN 4022
4088 RJUST= 0:DIGITS=0
4090 RETURN
4099 :
5000 : Get data from disk
5001 :
5010 OPEN #10,Z$::If can't open the line #9990 is called!!
5012 RECNO #10=1
5020 FOR X=1 TO 240
5030 READ #10,S(X,1),S(X,2),S(X,3)
5040 IF S(X,1)=0 THEN 5080
5050 NEXT X
5080 CLOSE #10
5090 RETURN
5099 :
6000 : Print a single years data
6001 :
6006 PRINT
6008 LET P1=0:S1=0:V1=0
6010 INPUT "Which years' data ",T
6011 LET X$=STR$(T)+"1"
6012 FOR Y = 1 TO 240 STEP 12
6014 LET T$=STR$(S(Y,1))
6016 IF X$=T$ THEN 6020
6018 NEXT Y
6019 PRINT "NOT ON FILE ":GOTO 6080
6020 IF Q1 =  7 THEN RETURN
6028 GOSUB 8000:: port?
6030 GOSUB 8100::HEADING
6040 GOSUB 6100
6080 PRINT
6082 INPUT "Want another years' data  ( Y or N ) ",Q$
6084 IF Q$ = "y" THEN Q$="Y"
6086 IF Q$= "Y" THEN 6000
6090 RETURN
6099 :
6100 : Scan and print one year
6101 :
6140 FOR X = Y TO Y+11
6142 PRINT #Q,X-Y+1,
6144 LET Z=S(X,3)/S(X,2)*100
6146 LET P1=P1+S(X,2):S1=S1+S(X,3)
6148 DIGITS= 1:RJUST = 3
6150 PRINT #Q,S(X,2),S(X,3),Z
6152 DIGITS= 0:RJUST = 0
6160 NEXT X
6170 LET U$="==":GOSUB 8200::underline$
6172 RJUST= 2:DIGITS=1
6174 PRINT #Q,"Totals",P1,S1,S1/P1*100
6180 DIGITS= 0:RJUST = 0
6190 RETURN
6199 :
7000 : Insert other data
7001 :
7010 GOSUB 6000::Get position in the array
7020 HOME
7022 PRINT "Year -> ";T
7024 PRINT "Month","Old Plan","Old Bookings"
7030 FOR X = Y TO Y+11
7032 PRINT X-Y+1,S(X,2),S(X,3),
7034 INPUT "New Plan, Bookings ",S(X,2),S(X,3)
7040 NEXT X
7080 INPUT "Want to change another years' data (Y/N) ",Q$
7082 IF Q$ = "Y" THEN 7000
7090 RETURN
7099 :
8000 : Port
8001 :
8010 INPUT "Which port  ",Q
8012 IF Q <> 3 THEN Q = 1
8020 IF Q=1 IF Q1<>1 THEN HOME
8090 RETURN
```

More

NEW! TPM* for TRS-80 Model II
NEW! System/6 Package
Computer Design Labs

Z80* Disk Software

We have acquired the rights to all TDL software (& hardware). TDL software has long had the reputation of being the best in the industry. Computer Design Labs will continue to maintain, evolve and add to this superior line of quality software.
— Carl Galletti and Roger Amidon, owners.

Software with Manual/Manual Alone

All of the software below is available on any of the following media for operation with a Z80 CPU using the CP/M* or similar type disk operating system (such as our own TPM*).

for TRS-80* CP/M (Model I or II)
for 8" CP/M (soft sectored single density)
for 5¼" CP/M (soft sectored single density)
for 5¼" North Star CP/M (single density)
for 5¼" North Star CP/M (double density)

BASIC I
A powerful and fast Z80 Basic interpreter with EDIT, RENUMBER, TRACE, PRINT USING, assembly language subroutine CALL, LOADGO for "chaining", COPY to move text, EXCHANGE, KILL, LINE INPUT, error intercept, sequential file handling in both ASCII and binary formats, and much, much more. It runs in a little over 12 K. An excellent choice for games since the precision was limited to 7 digits in order to make it one of the fastest around. $49.95/$15.

BASIC II
Basic I but with 12 digit precision to make its power available to the business world with only a slight sacrifice in speed. Still runs faster than most other Basics (even those with much less precision). $99.95/$15.

BUSINESS BASIC
The most powerful Basic for business applications. It adds to Basic II with random or sequential disk files in either fixed or variable record lengths, simultaneous access to multiple disk files, PRIVACY command to prohibit user access to source code, global editing, added math functions, and disk file maintenance capability without leaving Basic (list, rename, or delete). $179.95/$25.

ZEDIT
A character oriented text editor with 26 commands and "macro" capability for stringing multiple commands together. Included are a complete array of character move, add, delete, and display function. $49.95./$15.

ZTEL
Z80 Text Editing Language - Not just a text editor. Actually a language which allows you to edit text and also write, save, and recall programs which manipulate text. Commands include conditional branching, subroutine calls, iteration, block move, expression evaluation, and much more. Contains 36 value registers and 10 text registers. Be creative! Manipulate text with commands you write using Ztel. $79.95/$25.

TOP
A Z80 Text Output Processor which will do text formatting for manuals, documents, and other word processing jobs. Works with any text editor. Does justification, page numbering and headings, spacing, centering, and much more! $79.95/$25.

MACRO I
A macro assembler which will generate relocateable or absolute code for the 8080 or Z80 using standard Intel mnemonics plus TDL/Z80 extensions. Functions include 14 conditionals, 16 listing controls, 54 pseudo-ops, 11 arithmetic/logical operations, local and global symbols, chaining files, linking capability with optional linker, and recursive/reiterative macros. This assembler is so powerful you'll think it is doing all the work for you. It actually makes assembly language programming much less of an effort and more creative. $79.95/$20.

MACRO II
Expands upon Macro I's linking capability (which is useful but somewhat limited) thereby being able to take full advantage of the optional Linker. Also a time and date function has been added and the listing capability improved. $99.95/$25.

LINKER
How many times have you written the same subroutine in each new program? Top notch professional programmers compile a library of these subroutines and use a Linker to tie them together at assembly time. Development time is thus drastically reduced and becomes comparable to writing in a high level language but with all the speed of assembly language. So, get the new CDL Linker and start writing programs in a fraction of the time it took before. Linker is compatible with Macro I & II as well as TDL/Xitan assemblers version 2.0 or later. $79.95/$20.

DEBUG I
Many programmers give up on writing in assembly language even though they know their programs would be faster and more powerful. To them assembly language seems difficult to understand and follow, as well as being a nightmare to debug. Well, not with proper tools like Debug I. With Debug I you can easily follow the flow of any Z80 or 8080 program. Trace the program one step at a time or 10 steps or whatever you like. At each step you will be able to see the instruction executed and what it did. If desired, modifications can then be made before continuing. It's all under your control. You can even skip displaying a subroutine call and up to seven breakpoints can be set during execution. Use of Debug I can pay for itself many times over by saving you valuable debugging time. $79.95/$20.

DEBUG II
This is an expanded debugger which has all of the features of Debug I plus many more. You can "trap" (i.e. trace a program until a set of register, flag, and/or memory conditions occur). Also, instructions may be entered and executed immediately. This makes it easy to learn new instructions by examining registers/memory before and after. And a RADIX function allows changing between ASCII, binary, decimal, hex, octal, signed decimal, or split octal. All these features and more add up to give you a very powerful development tool. Both Debug I and II must run on a Z80 but will debug both Z80 and 8080 code. $99.95/$20.

ZAPPLE
A Z80 executive and debug monitor. Capable of search, ASCII put and display, read and write to I/O ports, hex math, breakpoint, execute, move, fill, display, read and write in Intel or binary format tape, and more! on disk

APPLE
8080 version of Zapple

NEW! TPM now available for TRS-80 Model II!

TPM*
A NEW Z80 disk operation system! This is not CP/M*. It's better! You can still run any program which runs with CP/M* but unlike CP/M* this operating system was written specifically for the Z80* and takes full advantage of its extra powerful instruction set. In other words its not warmed over 8080 code! Available for TRS-80* (Model I or II). Tarbell, Xitan DDDC, SD Sales "VERSA-FLOPPY", North Star (SD&DD), and Digital (Micro) Systems. $79.95/$25.

SYSTEM MONITOR BOARD (SMB II)
A complete I/O board for S-100 systems. 2 serial ports, 2 parallel ports, 1200/2400 baud cassette tape interface, sockets for 2K of RAM, 3-2708/2716 EPROM's or ROM, jump on reset circuitry. Bare board $49.95/$20.

ROM FOR SMB II
2KX8 masked ROM of Zapple monitor. Includes source listing $34.95/$15.

PAYROLL (source code only)
The Osborne package. Requires C Basic 2.
5" disks $124.95 (manual not included)
8" disks $ 99.95 (manual not included)
Manual $20.00

ACCOUNTS PAYABLE/RECEIVABLE (source code only)
By Osborne, Requires C Basic 2
5" disks $124.95 (manual not included)
8" $99.95 (manual not included)
Manual $20.00

GENERAL LEDGER (source code only)
By Osborne. Requires C Basic 2
5" disks $99.95 (manual not included)
8" disks $99.95 (manual not included)
Manual $20.00

C BASIC 2
Required for Osborne software. $99.95/$20.

SYSTEM/6
TPM with utilities, Basic I interpreter, Basic E compiler, Macro I assembler, Debug I debugger, and ZEDIT text editor.
Above purchased separately costs $339.75
Special introductory offer: Only $179.75 with coupon!!

$160.

This Coupon Is Worth One Hundred And Sixty Dollars Toward The Full Price Of The SYSTEM/6 Package
System/6 with this coupon is only $179.95.
This is a limited time offer.

$160.00

ORDERING INFORMATION
Visa, Master Charge and C.O.D. O.K. To order call or write with the following information.

1. Name of Product (e.g. Macro I)
2. Media (e.g. 8" CP/M)
3. Price and method of payment (e.g. C.O.D.) include credit card info. if applicable.
4. Name, Address and Phone number.
5. For TPM orders only: Indicate if for TRS 80, Tarbell, Xitan DDDC, SD Sales (5¼" or 8"). ICOM (5¼" or 8"), North Star (single or double density) or Digital (Micro) Systems.
6. N.J. residents add 5% sales tax.

Manual cost applicable against price of subsequent software purchase in any item except for the Osborne software.

For information and tech queries call
609-599-2146

For phone orders ONLY call toll free
1-800-327-9191
Ext. 676
(Except Florida)

OEMS
Many CDL products are available for licensing to OEMs. Write to Carl Galletti with your requirements.

* Z80 is a trademark of Zilog
* TRS-80 is a trademark for Radio Shack
* TPM is a trademark of Computer Design Labs. It is not CP/M*
* CP/M is a trademark of Digital Research

Prices and specifications subject to change without notice.

DEALER INQUIRIES INVITED.

COMPUTER DESIGN LABS
342 Columbus Avenue
Trenton, N.J. 08629

✓18

✓See List of Advertisers on page 210

Listing continued.

```
8099 :
8100 : Print Headings
8101 :
8110 IF Q=1 THEN HOME
8142 IF Y>240 THEN Y=1
8144 IF Y=0 THEN Y=1
8145 IF Q1=3 THEN T=Y:GOTO 8150::making new data
8146 LET T$=STR$(S(Y,1))
8148 LET T=VAL(LEFT$(T$,2))
8150 PRINT #Q, "YEAR  = '";T
8160 PRINT #Q,         ,"Plan","Bookings","Bookings/Plan"
8170 PRINT #Q,"Month","(K dollars)","(K dollars)","(  %   )"
8180 LET U$ = "--" : GOSUB 8200
8182 LET P1=0:S1=0:V1=0::Reset
8190 RETURN
8199 :
8200 : Print underline
8201 :
8220 FOR K=1 TO 30
8230 PRINT #Q,U$;
8240 NEXT K
8280 PRINT #Q
8290 RETURN
8299 :
9800 : Pgm. Variables
9801 :
9808 INPUT "Specify the y-axis resolution ",R1
9810 DIM S(240,3)::Data Array
9811 DIM Z(R1,12)::The z-chart array
9812 DIM G(4,12)::Temporary storage array
9814 LET W=30:LINE=0
9816 LET Y1=71:Y2=90::    from 1971 to 1990
9820 LET Z$="ZCHART.DAT"
9822 LET M$="Z-Charting a business"
9824 LET S$="Data from 19"+STR$(Y1)+" to 19"+STR$(Y2)
9830 FOR X = 1 TO 8
9832 READ N$(X),N(X)
9834 LET C1=C1+1:: Counter for items in menu
```

More

Listing continued.

```
9836 NEXT X
9890 RETURN
9899 :
9900 : Data
9901 :
9910 DATA Plot the Z-Chart,2000
9912 DATA Save data on disk,3000
9920 DATA Make new data,1000
9922 DATA Print ALL the data,4000
9930 DATA Get data from disk,5000
9940 DATA Print a single years' data,6000
9950 DATA Insert one years' data,7000
9960 DATA Terminate,900
9981 :
9990 IF ERCODE = 8 PRINT "Company went bankrupt.":WAIT 5:GOTO 100
9992 PRINT "Error found in line ";ERLINE
9994 PRINT "Error code was ";ERCODE
9999 END
```

Listing 2. ZLIST.BAS.

```
0001 : ZLIST.BAS
0002 :
0003 : Gene Embry
0004 :
0010 ON ERROR GOTO 9990
0020 GOSUB 9800::   Program initialization
0099 :
0100 : Main
0101 :
0110 HOME
0112 LET DIGITS=0:RJUST=0
0120 PRINT TAB(W-LEN(M$)/2);M$:PRINT
0122 PRINT TAB(W-LEN(S$)/2);S$:PRINT
0128 PRINT
```

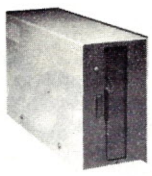
More

Listing continued.

```
0130 GOSUB 8000::Port
0138 PRINT "Gettins data"
0140 GOSUB 5000::Get data
0150 GOSUB 8100::Print headins
0160 GOSUB 1000::Print the data
0190 GOSUB 8200::Print underline
0199 :
0900 : Done
0901 :
0990 END
0999 :
1000 : Print data compacted
1001 :
1010 FOR Y = 1 TO 240 STEP 12
1012 LET T$=STR$(S(Y,1))
1020 LET T$=LEFT$(T$,2)
1022 PRINT #Q,T$;
1030 FOR X = 1 TO 12
1032 LET A = S(Y+X-1,2):B=S(Y+X-1,3)
1034 LET X$=STR$(A)+"/"+STR$(B)
1036 PRINT #Q,TAB(TO*X);X$;
1038 NEXT X
1040 PRINT #Q
1080 NEXT Y
1090 RETURN
1099 :
5000 : Get data from disk
5001 :
5010 OPEN #10,Z$::If can't open the line #9990 is called!!
5012 RECNO #10=1
5020 FOR X=1 TO 240
5030 READ #10,S(X,1),S(X,2),S(X,3)
5040 IF S(X,1)=0 THEN 5080
5050 NEXT X
5080 CLOSE #10
5090 RETURN
5099 :
8000 : Port of print
8001 :
8010 INPUT "Which port  ",Q
8012 IF Q <> 3 THEN Q = 1
8090 RETURN
8099 :
8100 : Print Headins
8101 :
8110 IF Q=1 THEN HOME
8120 PRINT #Q,TAB(2*W);"Entire data file"
8122 PRINT #Q,TAB(2*W);"PLAN/BOOKINGS"
8124 PRINT #Q,TAB(TO);"Months  -->"
8126 LET U$="==":GOSUB 8200::Print underline
8130 PRINT #Q,"Year";
8140 FOR X = 1 TO 12
8142 PRINT #Q,TAB(X*TO);X;
8148 NEXT X
8150 PRINT #Q
8160 GOSUB 8200::Print underline
8190 RETURN
8199 :
8200 : Print underline
8201 :
8220 FOR K=1 TO 58
8230 PRINT #Q,U$;
8240 NEXT K
8280 PRINT #Q
8290 RETURN
8299 :
9800 : Pgm. Variables
9801 :
9810 DIM S(240,3)::Data Array
9812 LET M$="List z-chart data - compact form"
9814 LET W=30:LINE=0:TO=9
9816 LET A=0:B=0
9818 LET Y1=71:Y2=90::    from 1971 to 1990
9820 LET Z$="ZCHART.DAT"
9824 LET S$="Data from 19"+STR$(Y1)+" to 19"+STR$(Y2)
9890 RETURN
9899 :
9900 : Data
9901 :
9990 PRINT
9992 IF ERCODE = 8 PRINT "Company went bankrupt.":WAIT 5:GOTO 100
9994 PRINT "Error found in line ";ERLINE
9996 PRINT "Error code was ";ERCODE
9999 END
```

WE WILL NOT BE UNDERSOLD

DISK DRIVES



FOR TRS-80* Model I

CCI-100	5¼", 40 Track (102K)	**$299**

ADD-ON DRIVES FOR ZENITH Z-89

CCI-189	5¼", 40 Track (102K)	**$389**
Z-87	Dual 5¼" system	**$995**

External card edge and power supply included. 90 day warranty/one year on power supply.

CORVUS	5 mg **$3089**	10 mg **$4489**	Mirror	**$699**
RAW DRIVES		8" SHUGART 801R		**$399**
5¼" TANDON	**$ CALL**		POWER SUPPLIES	**$ CALL**

DISKETTES — Box of 10

5¼"	**Maxell $40**	**BASF/Verbatim**	**$26.95**
8"	**Maxell $45**	**BASF/Verbatim**	**$36.00**
PLASTIC FILE BOX–Holds 50 5¼" diskettes			**$19.00**
PLASTIC LIBRARY CASE	5¼" **$3.00**	8"	**$ 4.00**
HEAD CLEANING DISKETTE			**$25.00**
FLOPPY SAVER	**$10.95**	RINGS	**$ 6.95**

16K RAM KITS

	2 for $37	**$19**
200ns for TRS-80,* Apple II, (specify):	**Jumpers**	**$2.50**

COMPUTERS/SYSTEMS

ALTOS	ACS8000 Series		**$CALL**
ZENITH	48K, all-in-one computer		**$2149**
ATARI	400 **$ 359**	800	**$ 789**
MATTEL	INTELLIVISION		**$ 259**
APPLE PERIPHERALS			**$CALL**

TERMINALS

ADDS	Viewpoint			**$CALL**
ZENITH	Z-19			**$ 725**
TELEVIDEO	910 **$ 559**	920C **$729**	950	**$ 929**
IBM	3101-10			**$1189**

S-100 CALIFORNIA COMPUTER SYSTEMS

MAINFRAME	**$349**	**Z80 CPU**	**$ 239**
64K RAM	**$569**	**FLOPPY DISC CNTRL**	**$ 339**

INTEGRATED SYSTEM W/INTERNAL CABLES, TESTED	**$1975**
2P + 2S I/O	**$ 269**
4 PORT SERIAL I/O	**$ 249**
4 PORT PARALLEL I/O	**$ 179**
CABLES	**$CALL**

CASIO CALCULATORS

POCKET COMPUTER	FX702	**$199.00**
DESK PRINTER/CALCULATOR	FR100	**$ 79.95**
SCIENTIFIC CALCULATOR	FX8100	**$ 49.95**
GAME WATCH	CA90 Plastic	**$ 49.95**
GAME WATCH	CA901 Steel	**$ 69.95**
SPORT WATCH	AX210 Calendar	**$ 59.95**

BUSINESS SOFTWARE

WORDSTAR for Apple II	**$ 329**
WORDSTAR for Zenith Z89	**$ 329**

PRINTERS

NEC SPINWRITER

7710 R.O. Par	**$2395**
7710 R.O. Par w/tractor	**$2595**
7720 KSR w/tractor	**$2795**
7730 R.O. Ser	**$2395**
7730 R.O. Ser w/tractor	**$2595**
NEW 3500 Series	**$CALL**

EPSON	MX-70 MX-80 MX-80FT MX100	**$CALL**
PAPER TIGER		
IDS 445	Graphics & 2K buffer	**$ 639**
IDS 460	Graphics & 2K buffer	**$ 799**
IDS 560	Graphics	**$1049**
ACCESSORIES		**$CALL**
ANADEX	DP-8000 **$849** DP-9500/01	**$1389**
OKIDATA		
Microline 80	Friction & pin feed	**$CALL**
Microline 82	Friction & pin feed	**$CALL**
Microline 83	120 cps, uses up to 15" paper	**$CALL**
Call for new Microline series!		
CENTRONICS	739, new model with graphics	**$ 739**
C. ITOH		
Starwriter I	25 cps, parallel interface	**$1525**
Starwriter I	25 cps, serial interface	**$1620**
Starwriter II	45 cps, parallel interface	**$1950**
Starwriter II	45 cps, serial interface	**$2075**
AXIOM	GP-80M	**$ 319**
DATA SOUTH	180 cps	**$CALL**

MONITORS

BELL & HOWELL	9" B & W BHD911			**$155**
LEEDEX	12" B & W	**$129**	12" Green Screen	**$155**
	13" Color	**$329**		
SANYO	9" B & W	**$149**	12" Green Screen	**$238**
	12" B & W	**$219**	13" Color	**$399**
ZENITH	13" Color	**$349**	12" Green Screen	**$129**

TELECOMMUNICATIONS

PRENTICE STAR MODEM 1-year guarantee				**$125**
UNIVERSAL DATA SYSTEMS	UDS103LP	**$149**	UDS103JP	**$215**
NOVATION	CAT	**$139**	D-CAT	**$149**
	AUTO-CAT	**$199**	APPLE CAT II	**$339**
D.C. HAYES	SMART/STACK MODEM			**$235**
	MICRO-MODEM II			**$295**
CCI Telnet Communications Package				**$135**

APPLE ACCESSORIES AND SOFTWARE

Mfr. by: Microsoft – Mountain Computers – Videx – CCS – Personal Software

VISICALC	**$159.00**	**VISIDEX**	**$159.00**
VISITERM	**$119.00**	**VISIPLOT**	**$139.00**
Z-80 SOFTCARD	**$259.00**	**VIDEX BOARD**	**$249.00**
KEYBOARD ENHANCER	**$110.00**	**16K CARD**	**$159.00**
APPLE JOYSTICK	**$ 49.00**	**SUP-R FAN**	**$ 39.00**
SUP-R MOD	**$ 25.00**	**CCS CARDS**	**$ CALL**
APPLE CARDS	**$ CALL**	**ASCII EXPRESS**	**$ 59.00**
SUPERCALC	**$199.00**	**ALF9 VOICE BOARD**	**$149.00**
CPS MULTIFUNCTION CARD			**$199.00**

ENTERTAINMENT

Mfr. by: On Line – Broderbund – Sirius – California Pacific

FLIGHT SIMULATOR	**$29.00**	**SARGON II**	**$29.00**
WIZARD & PRINCESS	**$28.00**	**ABM**	**$21.95**
MYSTERY HOUSE	**$24.00**	**GORGON**	**$34.95**
HI-RES FOOTBALL	**$35.00**	**MICROPAINTER**	**$29.00**
RASTER BLASTER	**$25.95**	**APPLE PANIC**	**$27.95**
SPACE EGGS	**$17.95**	**MATTEL GAMES**	**$27.00**

For fast delivery, send certified checks, money orders or call to arrange direct bank wire transfers. Personal or company checks require two to three weeks to clear. All prices are **mail order only** and are subject to change without notice. **Call for shipping charges.**

DEALER (NATIONAL/INTERNATIONAL) INQUIRIES INVITED **Send for FREE Catalogue**

The CPU SHOP

256

TO ORDER CALL TOLL FREE 1-800-343-6522

TWX: 710-348-1796 Massachusetts Residents call 617/242-3361

5 Dexter Row, Dept. K12M
Charlestown, Massachusetts 02129
Hours 10AM-6PM (EST) Mon.-Fri. (Sat. till 5)

Technical Information call 617/242-3361
Massachusetts Residents add 5% Sales Tax
Tandy Corporation Trademark/®Digital Research

master charge

VISA

Maximize the potential of your TRS-80*

Encyclopedia for the TRS-80*

What's the key to getting the most from your TRS-80*? No, it isn't disk drives or printers or joysticks. It's information. Without a continual supply of information and ideas, you cannot realize the full potential of the TRS-80*.

Our response to the clamor for additional information is the *Encyclopedia for the TRS-80*,* a ten-volume reference work of programs and articles carefully selected to help you make the most of your microcomputer. You can consider the volumes of the *Encyclopedia* to be an extension of the documentation that came with your TRS-80* Each book is full of material on programming techniques, business, language, hardware, games, tutorials, education, utilities and interfacing.

Unlike conventional encyclopedias, the *Encyclopedia for the TRS-80** will never become stale or out of date. That's because the volumes of the *Encyclopedia* are being issued one-at-a-time, approximately six weeks apart. This means that each new volume will reflect the latest developments and discoveries, making this a living encyclopedia for TRS-80* users.

The first four volumes are being issued during 1981. The remaining volumes will be issued during the first half of 1982. The deluxe COLLECTOR'S EDITION has a handsome green and black hard cover with a dust jacket.
A soft cover edition is also available.

DEALERS Please request discount information and catalog when ordering. Mail Dealer orders ATT: Wayne Green Books Dealer Sales.

WAYNE GREEN BOOKS
A division of Wayne Green Inc.
Pine Street
Peterborough, NH 03458

Encyclopedia Loader

The editors at Wayne Green Books want to help you use the programs in your *Encyclopedia for the TRS-80**. So to help you maximize the use of your microcomputing time, we created **Encyclopedia Loader™.**

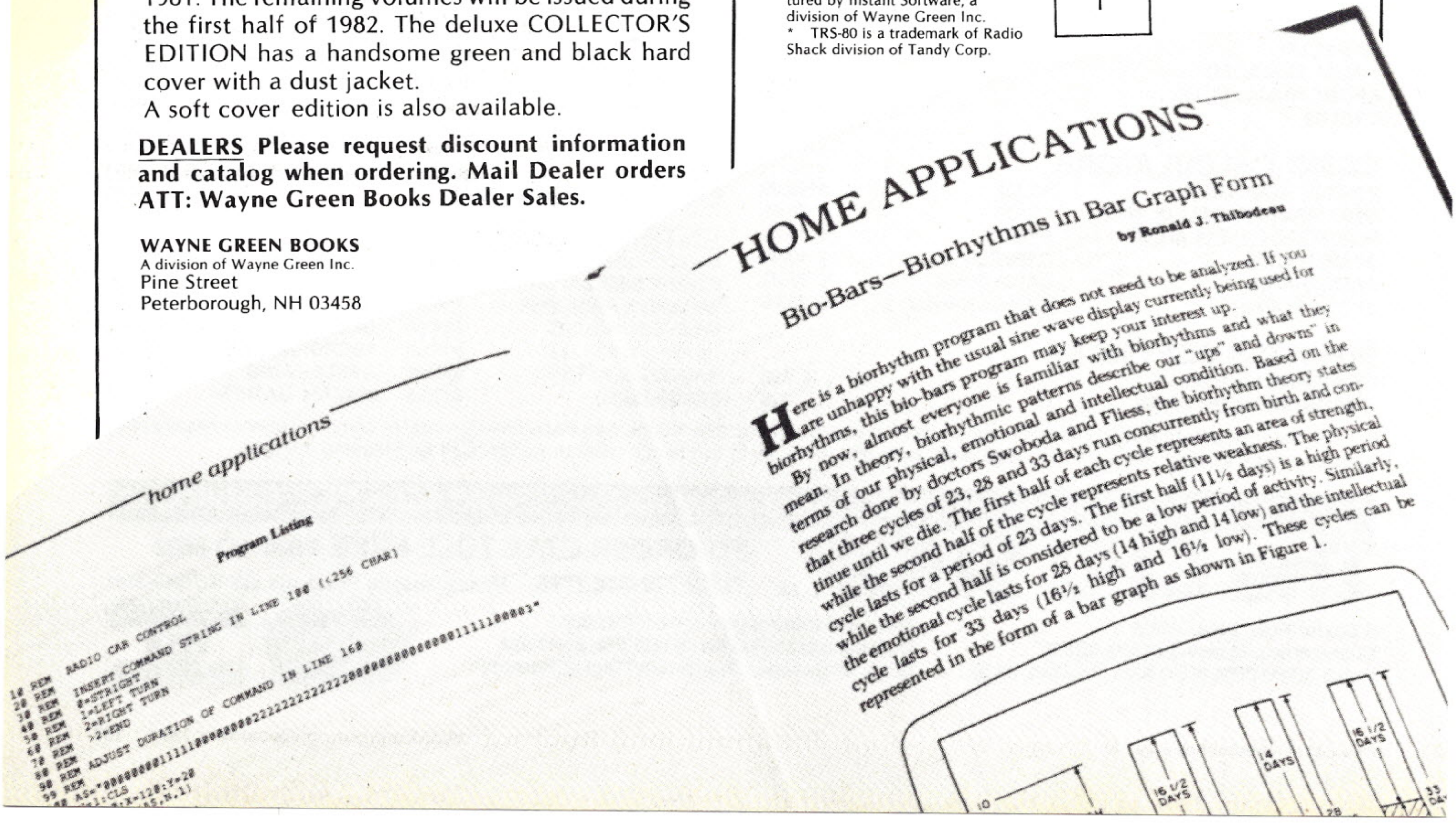
By a special arrangement with Instant Software™, Wayne Green Books can now provide you with selected programs contained in each volume of the *Encyclopedia for the TRS-80** on a special series of cassettes called **Encyclopedia Loader™**. Your encyclopedia provides the essential documentation but now you'll be able to load the programs instantly.

With **Encyclopedia Loader™** you'll save hours of keyboard time and eliminate the aggravating search for typos.

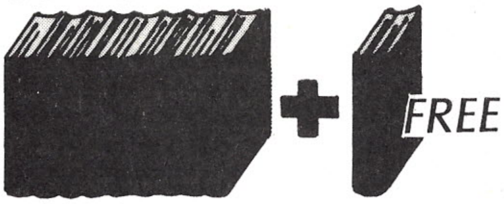
Save money with this introductory offer. **Encyclopedia Loader™** for Volume 1 of *Encyclopedia for the TRS-80** which will normally cost $14.95 is available **for a limited time only at the introductory price of $12.95.**

To order specify EL8001 $12.95.

The Encyclopedia for the TRS-80 is a Wayne Green publication. Encyclopedia Loader is manufactured by Instant Software, a division of Wayne Green Inc.
* TRS-80 is a trademark of Radio Shack division of Tandy Corp.



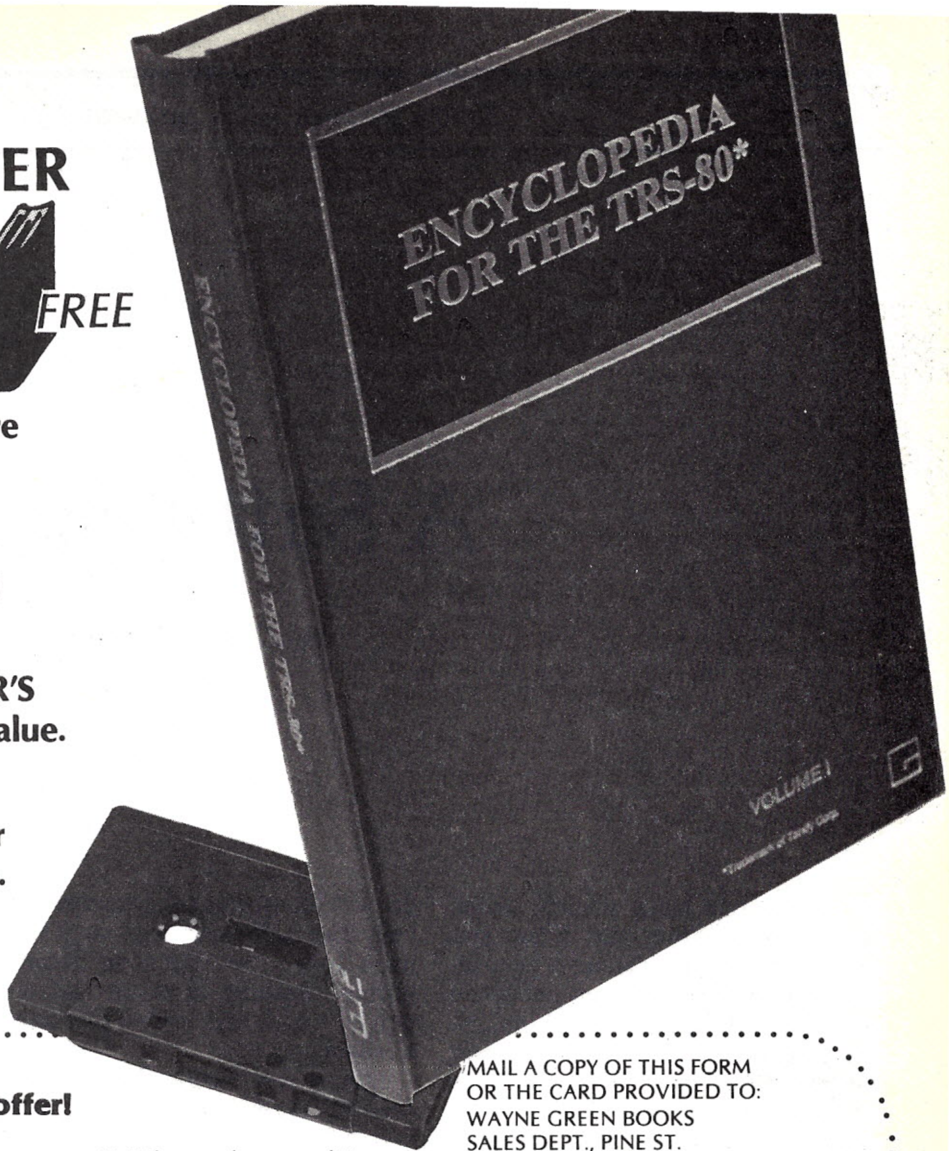
SPECIAL OFFER



If you order the entire ten volume set of the Encyclopedia for the TRS-80,* you'll receive the tenth volume FREE!

10 Volume deluxe hard cover COLLECTOR'S EDITION—a $199.50 value.
$164.00 EN8100 postpaid

10 Volume soft cover edition, a $109.50 value.
$83.00 EN8080 postpaid



YES, I want your special offer!

____10 Volume deluxe hard cover COLLECTOR'S EDITION—a $199.50 value. EN8100 $164.00

____10 Volume soft cover edition—a $109.50 value. EN8080 $83.00

MAIL A COPY OF THIS FORM OR THE CARD PROVIDED TO:
WAYNE GREEN BOOKS
SALES DEPT., PINE ST.
PETERBOROUGH, NH 03458
OR CALL **TOLL FREE**
1-800-258-5473

To order single hard cover volumes of the *Encyclopedia* please specify:		To order single soft cover volumes of the *Encyclopedia* please specify:		To order **Encyclopedia Loader™** cassettes please specify:	
____Volume 1	EN8101 $19.95*	____Volume 1	EN8081 $10.95*	____Volume 1	EL8001 $12.95*
____Volume 2	EN8102 $19.95*	____Volume 2	EN8082 $10.95*	____Volume 2	EL8002 $14.95*
____Volume 3	EN8103 $19.95*	____Volume 3	EN8083 $10.95*	____Volume 3	EL8003 $14.95*
____Volume 4	EN8104 $19.95*	____Volume 4	EN8084 $10.95*	____Volume 4	EL8004 $14.95*
____Volume 5	EN8105 $19.95*	____Volume 5	EN8085 $10.95*	____Volume 5	EL8005 $14.95*
____Volume 6	EN8106 $19.95*	____Volume 6	EN8086 $10.95*	____Volume 6	EL8006 $14.95*
____Volume 7	EN8107 $19.95*	____Volume 7	EN8087 $10.95*	____Volume 7	EL8007 $14.95*
____Volume 8	EN8108 $19.95*	____Volume 8	EN8088 $10.95*	____Volume 8	EL8008 $14.95*
____Volume 9	EN8109 $19.95*	____Volume 9	EN8089 $10.95*	____Volume 9	EL8009 $14.95*
____Volume 10	EN8110 $19.95*	____Volume 10	EN8090 $10.95*	____Volume 10	EL8010 $14.95*

PAYMENT ENCLOSED______ PLEASE CHARGE TO MY ____VISA ____MASTERCARD ____AMEX

CARD # ____________________ INTERBANK #__________ EXPIRES__________

NAME ____

ADDRESS ____

CITY ______________________ STATE__________ ZIP__________

SIGNATURE ____

*These prices do not include shipping and handling. Please add $1.50 per item in the U.S. and Canada. Allow 4-6 weeks after publication date for delivery. (All volumes will be shipped UPS if the complete street address is provided; otherwise shipment will be 4th class book rate.) Foreign orders please add $10.00 for airmail per item or $5.00 for surface mail per item. Delivery outside the U.S. varies. Prices are subject to change without notice. No C.O.D.'s.

KB12

Sailors go down to the sea, with their micros.

A Salty Saga

By Carle Collins

Life aboard a Navy aircraft carrier can be exciting and busy, but much of it is boring. There is very little to do during the hours not spent actually working or on watch: no corner pizza parlor where you can meet the gang for pizza and beer, no disco and no bowling alley. The average sailor contents himself with watching one-channel closed-circuit TV—if he doesn't like the show presented, too bad. The ambitious men may work extra hours, but this soon becomes boring. Reading is about the only other form of entertainment available.

After a few weeks at sea, it is no wonder these guys blow off steam when they hit port.

As a field engineer on contract to the government, I have lived and worked with sailors, and have experienced the same problems. On a recent assignment, I tried a project aimed at helping relieve the boredom and increasing their knowledge. I had found that most of the sailors with whom I worked knew very little about integrated circuits, although they worked with them each day. They used computer-controlled systems, automated test stations and other sophisticated equipment, but with the cookbook repair manuals, they did not really have to understand the circuitry involved.

So I approached some of them with the idea of forming a class, where I would teach them about integrated circuits and bring them up-to-date on microprocessors and microcomputers. The response to my suggestion was overwhelming. Of the 30 people working in the shop to which I was assigned, 25 wanted to participate, including the shop supervisors.

I set out to find a suitable textbook which would give a good, detailed explanation of the inner workings of a microprocessor and how it could be used in a system. My first stumbling block was getting books to review. Some readers may picture this as no task at all, since I only had to go to my nearest computer store and check over the books. Well, the nearest computer store happened to be about 900 miles away, across the open sea.

Since I was not a teacher at an established school, I had to buy any books I wanted to review. Needless to say, at the prices most vendors want for their publications, I didn't buy very many books just for review. Fortunately, I happened upon a review which credited the book's author with a good overview of the devices available and enough substance to make it suitable for my use. So I rushed an order to Sybex for a copy of Rodnay Zaks' book, *Microprocessors, from Chips to Systems.*

Ship to Shore

Now, rushing an order to someone from a ship at sea is not the same as doing it from your home. There is no telephone to call in the order or check on its status, and if you think the mail system within the States presents a

IC1	MCS6502 microprocessor
IC2	MCS6530-002 ROM/IO/timer
IC3,IC4	2114-L 1K×4 RAM
IC5,IC6	SN7442 decoder
IC7	MCS6520 peripheral interface adapter
IC8	SN7404 hex inverter
IC9,IC10	SN7406 hex buffer
IC11	SN7400 Quad 2-input Nand
Q1-Q6	2N2906A transistor
D1-D6	FND507 LED display
R1-R4	3.3k ohm resistor
R5	560 ohm resistor
R6	330k ohm resistor
R7-R12	1.0k ohm resistor
R13-R18	220 ohm resistor
R19-R25	82 ohm resistor
C1	10 pF capacitor
XTAL	1.0 MHz crystal
S1	SPST slide switch
S2,S3	SPDT push-button switch
Kbd	20-key calculator keyboard

Misc. = 4½ × 6½ perforated board, socket, wire

Parts list.

Address correspondence to Carle Collins, Rte. 2, Box 90-SC, Winter Garden, FL 32787.

problem, try the Fleet Postal Service. Well, about the time I was ready to try sending a carrier seagull, Zaks' book arrived. It seemed to fit our needs, so I collected the money and "rushed" another order for the 25 books we needed for the course.

While we were discussing the course one day, one of the men asked if he could build a microcomputer during the course. My response was, "Why not?" I began searching for a suitable computer at an affordable price, because naturally everyone else wanted to build one too. We got information on available kits, and, after looking them over, we decided the students would save money and learn more by actually building and debugging their own units from scratch. That way, they would certainly get to know the system better than if they just plugged in some chips and hooked up a power supply. Since I was the engineer of the group, they asked me for a design suggestion.

Fortune smiled again. A colleague joined the ship with his Heathkit Trainer, and a sailor from another shop heard of our course and told me of his KIM-1, which he was just completing. This sailor also happened to have all the issues of *Microcomputing* on board. I was ecstatic. I wrote to every company I could find that made components for microprocessors or computers, and, as might be expected, the responses ranged from nothing to fantastic.

RCA sent two 1802 chips and complete literature on the COSMAC series; Western Digital responded with several handsful of support chips and stacks of literature; Synertek sent detailed manuals on the 6500 series; Zilog sent manuals on the Z-80; and Intel sent catalog data on their products. It was all useful in selecting a system.

When I finally surfaced from my studies, I had a design. It would enable the student to build a simple microcomputer which he could program to perform simple tasks, and could eventually expand into a full-blown system if he wished. I based my decision on the availability of information on the particular device/system I selected, the price and availability of components and the existence of support hardware for future expansion. After evaluating all these points and the material I had available, I chose the system shown in the schematic diagram (see Fig. 1.)

The System

The 6502/6530-002 combination provides a CPU with a monitor program which includes a keyboard routine, display routine and a Teletype routine to which the student can progress as he studies. We could have written our own monitor programs, but this approach was quicker and time was running out. We were headed overseas soon, to be faced with the added complications of foreign mail services. The 6530-002 was available through a vendor, and we had the KIM-1 to familiarize us with its characteristics. If I were to do it over, I would probably write the programs: I'm older and wiser now.

At the current price of random access memory, it was economical to use the 2114Ls. With this much memory, the students could write sophisticated programs in machine language, and even advance to video display as their budgets and ability permitted. The low-power version of the chip provided almost twice as much memory, for the same power, as the standard.

The seven-segment display used common-anode devices readily available from several of the surplus houses, and was modeled to take ad-

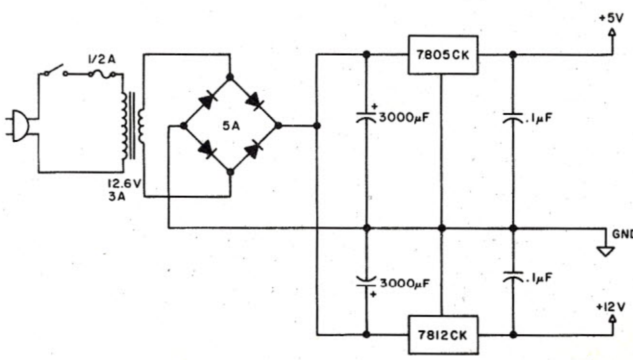


Fig. 3. Power supply.

vantage of the display routine inherent in the 6530–002.

The keyboard proved to be the most difficult problem. Hex keypads were available, at a price, and so were full 56-key/63-key keyboards, but the goal was an economical system which could be used and expanded at a later date. I finally found a 20-key calculator unit which might fit the bill. However, on its arrival I discovered it had one side of each switch connected to a common bus, and I wanted to use the matrix coding with the keyboard routine in the ROM/IO. Maybe the unit could be modified. Students carefully removed the push-button unit from the printed circuit board that formed the contacts and bus interconnections. The common bus was cut and #30 wire added to form two groups of seven switches and one group of six. They used an outboard switch for the remaining required function. Fig. 2 shows the before-and-after configurations of the keyboard unit. This portion of the work required some miniature soldering, but it could be done, with care, by a person with average skills.

The 6520 PIA was intended as an option to be added as the students progressed. When they considered the minor cost, they elected to purchase these chips with the other parts in order to have the necessary I/O ports for interface with the outside world. The experimenter never has

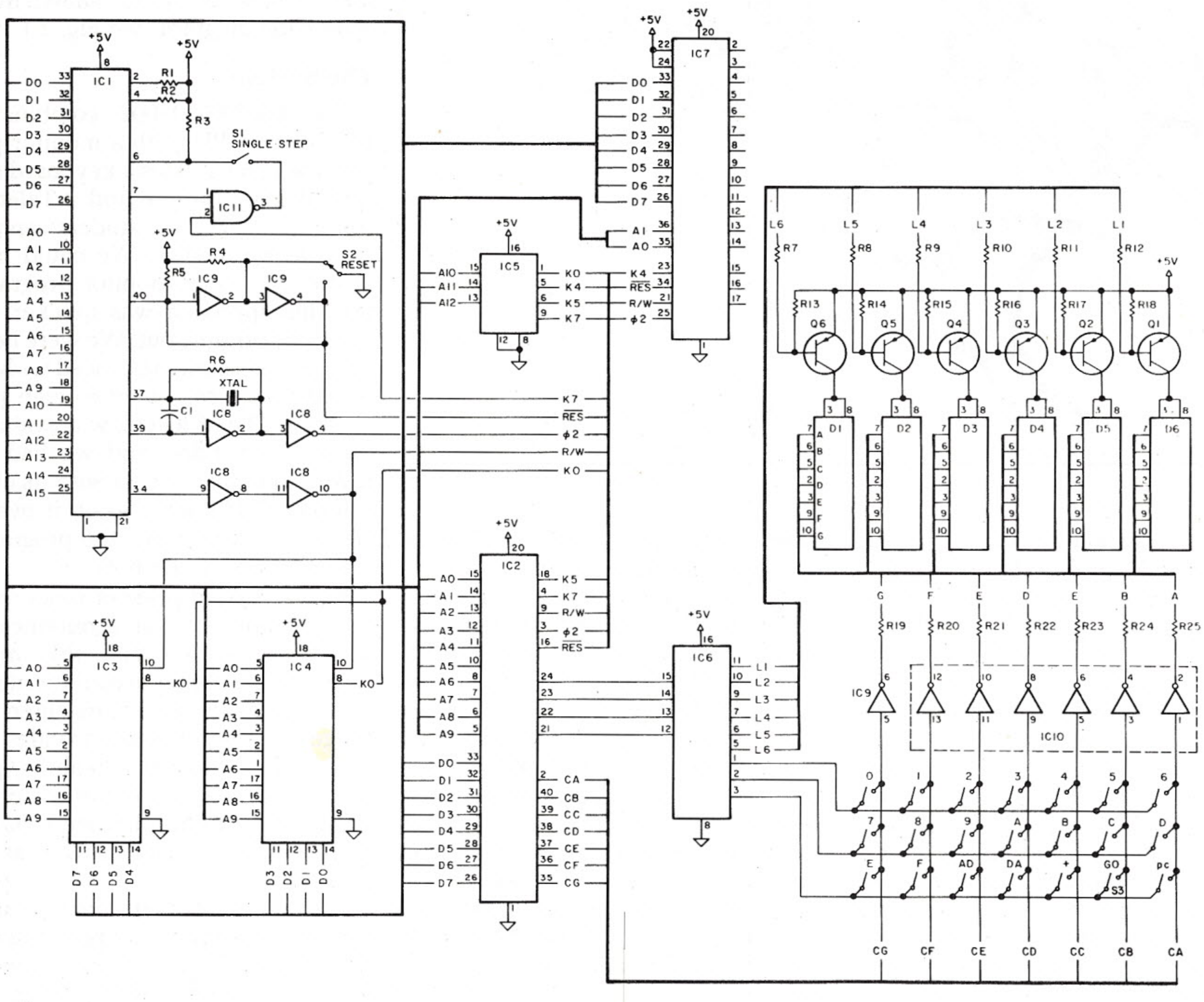


Fig. 1. System diagram.

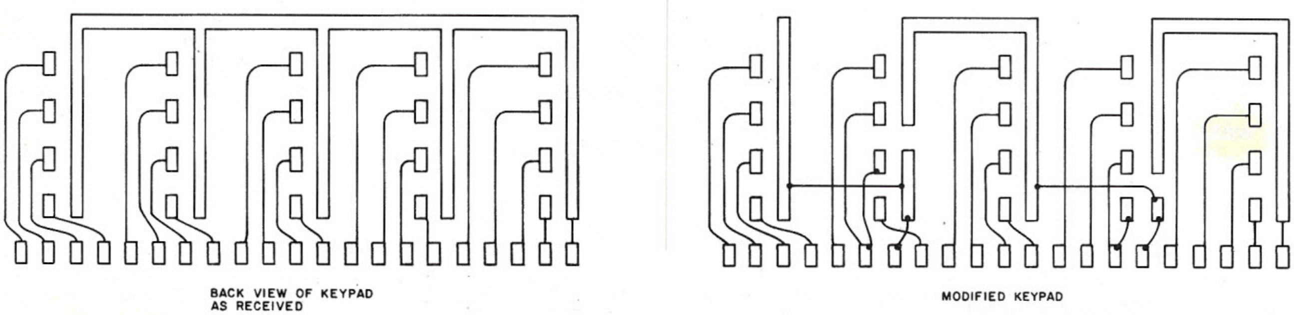
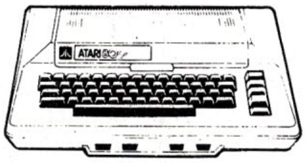


Fig. 2. Keypad modifications.

ATARI
Computers for people.™



800™ $749

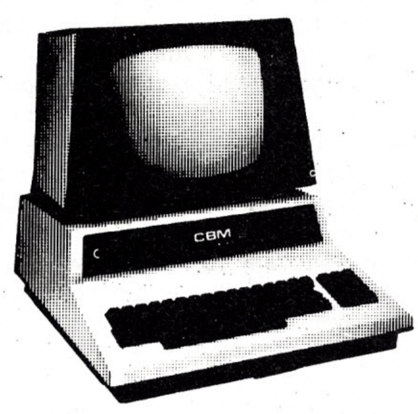
410 Recorder	$59.00
810 Disc Drive	$444.00
822 Printer	$359.00
825 Printer	$629.00
830 Modem	$159.00
820 Printer	$269.00
850 Interface	$159.00
New DOS 2 System	$21.00
CX70 Light Pen	$64.00
CX30 Paddle	$18.00
CX40 Joy Stick	$18.00
CX853 16K RAM	$89.00
Microtek 16K RAM	$75.00
Microtek 32K RAM	$169.00

400™ $329

ATARI SOFTWARE

CX404 Word Processor	$119.00
CX404 PILOT	$68.00
CX413 Microsoft Basic	$68.00
CX4101 Invitation To Programing I	$17.00
CX4102 Kingdom	$13.00
CX4103 Statistics	$17.00
CX4104 Mialing List	$17.00
CX4105 Blackjack	$13.00
CX4106 Invitation to Programing 2	$20.00
CX4107 Biorythm	$13.00
CX4108 Hangman	$13.00
CX4109 Graph It	$17.00
CX4110 Touch Typing	$20.00
CX4111 SPACE INVADERS	$17.00
CX4112 States & Capitals	$13.00
CX4114 European Countries & Capitals	$13.00
CX4115 Mortgage & Loan Analysis	$13.00
CX4116 Personal Fitness Program	$59.00
CX4117 Invitation To Programing 3	$20.00
CX4118-20 Conversational Languages (ea.)	$45.00
CX4121 Energy Czar	$13.00
CXL4001 Educational Master	$21.00
CX6001-17 Talk & Teach Series (ea.)	$23.00
CX8106 Bond Analysis	$20.00
CX8107 Stock Analysis	$20.00
CX8101 Stock Charting	$20.00
CXL4002 Basic Computing Language	$46.00
CXL4003 Assembler Editor	$46.00
CXL4004 Basketball	$24.00
CXL4005 Video Easel	$24.00
CXL4006 Super Breakout	$30.00
CXL4007 Music Composer	$45.00
CXL4009 Chess	$30.00
CXL4010 3-D Tic-Tac-Toe	$24.00
CLS4011 STAR RAIDERS	$39.00
CXL4012 MISSLE COMMAND	$32.00
CXL4013 ASTEROIDS	$32.00
CXL4015 TeleLink	$20.00
Visicalc	$149.00
Letter Perfect (Word Processor)	$109.00
Source	$89.00

commodore

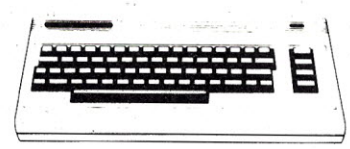


CBM 8032 $1149

4016	$799.00
4032	$999.99
8096	$1795.00
CBM4022 Printer	$629.00
Tally 8024	$1699.00
CBM C2N Cassette Drive	$69.00
CBM4040 Dual Disk Drive	$1039.00
CBM8050 Dual Disk Drive	$1349.00

SOFTWARE

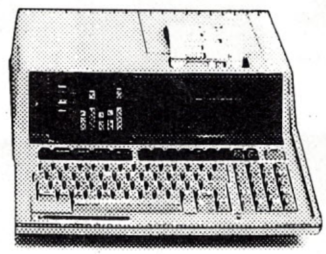
WordPro3 Plus	$229.00
WordPro4 Plus	$329.00
Commodore Tax Package	$399.00
Visicalc	$149.00
BPI General Ledger	$329.00
OZZ Information System	$329.00
Dow Jones Portfolio	$129.00
Pascal	$239.00
Legal Time Accounting	$449.00
Word Craft 80	$289.00
Create-A-Base	$249.00
Power	$89.00
Socket-2-Me	$20.00
Jinsam	$Call
MAGIC	$ Call



VIC 20 $259

Vic-TV Modual	$19.00
Vic Cassette	$69.00
Vic 6 Pack Program	$44.00
VIC1530 Commodore Datassette	$69.00
VIC1540 Disk Drive	$499.00
VIC1515 VIC Graphic Printer	$399.00
VIC1210 3K Memory Expander	$32.00
VIC1110 8K Memory Expander	$53.00
VIC1011 RS232C Terminal Interface	$43.00
VIC1112 VIC IEEE-488 Interface	$86.00
VIC1211 VIC 20 Super Expander	$53.00
VIC1212 Programmers Aid Cartridge	$45.00
VIC1213 VICMON Machine Language Monitor	$45.00
VIC1901 VIC AVENGERS	$23.00
VIC1904 SUPERSLOT	$23.00
VIC1906 SUPER ALIEN	$19.00
VIC1907 SUPER LANDER	$23.00
VIC1908 DRAW POKER	$23.00
VIC1909 MIDNIGHT DRIVE	$23.00
VT106A Recreation Pack A	$44.00
VT107A Home Calculation Pack A	$44.00
VT164 Programmable Character/Gramegraphics	$12.00
VT232 VICTerm I Terminal Emulator	$9.00

HEWLETT PACKARD

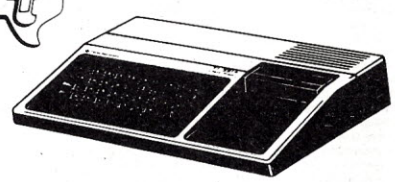


HP•85 $2595

NEW! HP•125	$3295.00
HP•83	$1795.00
HP•85 16K Memory Module	$249.00
5¼" Dual Master Disc Drive	$2129.00
Graphics Plotter (7225B)	$2079.00

Call for HP Software Prices & Information.

Texas Instruments



TI-99/4 $399

PHC 004 TI-99/4 Home Computer	$399.00
PHP 1600 Telephone Coupler	$169.00
PHP 1700 RS-232 Accessories Interface	$169.00
PHP 1800 Disk Drive Controller	$239.00
PHP 1850 Disk Memory Drive	$389.00
PHP 2200 Memory Expansion (32K RAM)	$239.00
PHA 2100 R.F. Modulator	$43.00
PHP 1100 Wired Remote Controllers(Pair)	$31.00
PHM 3006 Home Financial Decisions	$26.00
PHM 3013 Personal Record Keeping	$43.00
PHD 5001 Mailing List	$60.00
PHD 5021 Checkbook Manager	$18.00
PHM 3008 Video Chess	$60.00
PHM 3010 Physical Fitness	$26.00
PHM 3009 Football	$26.00
PHM 3018 Video Games I	$26.00
PHM 3024 Indoor Soccer	$26.00
PHM 3025 Mind Challengers	$22.00
PHM 3031 The Attack	$35.00
PHM 3032 Blasto	$22.00
PHM 3033 Blackjack and Poker	$22.00
PHM 3034 Hustle	$22.00
PHM 3036 Zero Zap	$18.00
PHM 3037 Hangman	$18.00
PHM 3038 Connect Four	$18.00
PHM 3039 Yahtzee	$22.00
PHM 3017 Terminal Emulator I	$39.00
PHM 3026 Extended Basic	$88.00
PHM 3035 Terminal Emulator II	$45.00

DISCS

Sycom Blank Disk (10)	$29.00
Maxell MD I	$36.00
Maxell MD II (10)	$46.00

PRINTERS

Epson MX-70	Call for Prices
Epson MX-80	
Epson MX-80 FT	
Diablo 630	
TEC 1500 Starwriter 25cps	$1495.00
TEC 1500 Starwriter 45cps	$1795.00

No Risk, No Deposit On Phone Orders, COD or Credit Card, Shipped Same Day You Call *

* on all in stock units

IN PA, CALL (717) 327-9575

(800) 233-8950

COMPUTER MAIL ORDER ✓384

501 E. THIRD ST., WILLIAMSPORT, PA 17701

OVER 40 YEARS EXPERIENCE IN SOPHISITICATED ELECTRONICS

To Order:

Phone orders invited (800 number is for order desk only). Or send check or money order and receive free shipping. Pennsylvania residents add 6% sales tax. Add 3% for Visa or M.C. Equipment is subject to price change and availability without notice. Please call between 11 AM & 6 PM.

✓See List of Advertisers on page 210

enough I/O ports as he expands, so this seemed wise.

The 12 V, 3 A transformer in the power supply (Fig. 3) may seem like overkill in such a small project, but this trainer was designed with expansion in mind. The unit allows the experimenter considerable leeway in his system without having to immediately purchase another. The regulators supplied 5 V dc at 1.5 A and 12 V dc at 1.5 A. The 12 V supply was provided for activation of devices in the interface, since 5 V relays and lamps are not as prevalent as 12 V devices.

The construction method got almost as much consideration as the design, because I wanted the students to learn as much as possible while saving on the expense. I considered printed circuit techniques, but rejected them in view of the virtual requirement for double-sided boards and the number of holes to be drilled to accommodate the sockets or chips. Based on their job experience, the students felt that being able to quickly substitute chips during troubleshooting would be a great advantage, so sockets became necessary. All of them were familiar with wire-wrapping techniques, so we chose perforated boards and wire-wrap sockets as the best compromise.

About the time we were ready to begin construction, the first daisy-chain wire-wrapping tool appeared on the market, and we bought one to evaluate. One man went ahead and started his unit using conventional wire-wrap, but when the new tool arrived and he saw the first board wired with it, he dismantled his unit and started over. The advantages were immediately obvious.

The layout of sockets and packaging of the units were left to the student and varied with individual taste. Some placed everything on one board and mounted it in a chassis of individual design. Others simply used three modular pieces, with the CPU and support on one board, the keyboard and display on another and the power supply built as a separate unit for use with other projects. Each student made a design he felt would be most useful to him. The only thing common to each was the numbering of sockets and components, so that one wire list and schematic would be sufficient.

Two valuable lessons were learned during the construction. Wire-wrapping of the round leads found on discrete components resulted in intermittents as the circuits were used and tested, because the test probe caused the wraps to loosen. The basic premise of wire-wrap is that the square corners of the posts dig into the wire and prevent loosening of the wrap. We solved that problem with the round leads by pre-tinning each one with solder, making the wrap and then sweating the joint with a soldering iron. This resulted in reliable joints which would withstand the probes of test equipment and yet did not detract from the overall efficiency of the wire-wrapping technique.

The other lesson was in the use of the polyethylene-insulated wire sent with the wire-wrap tool. Care must be taken to ensure that sufficient slack is left in each run of the wire to prevent chafing against posts or other wires. The insulation is very fragile and will quickly chafe and cause shorts, making troubleshooting very difficult.

The students bought their parts as a group to take advantage of quantity discounts, and I acted as their purchasing agent. This is one task I don't want again! Between the mail hang-ups and the vendors' stock problems, a three-to-four-week task required four months, and I was asked every day, "Have you heard anything from our parts?"

Sockets were the major problem and naturally the wiring had to wait until they were on hand. Most of the classroom training was complete before they all arrived and the work could begin. The students were thus more knowledgeable about the circuitry, but the value of having experiments to perform with the lectures was lost.

Shipshape

In spite of all the problems that arose with this project, the overall results were gratifying. The students completed their computers, and some expanded to larger systems and even got into robotics and word-processing systems. They had learned enough to proceed on their own, and used me only as a sounding board for their ideas.

I recently received a call from one young man who left the Navy and got a job in industry. He told me that the training he got in that course directly enabled him to get his position with a large aerospace company. Results like this compensate for most of the headaches.■

You may be using this little-known Boolean operation in a variety of ways and not realize it.

More for the XOR

By Allan D. Pratt

```
0001 'Simple Blinker Routine, to flash error message
0002 'Makes use of bit-flipping ability of XOR function
0003 'Written in Microsoft BASIC
0010 TEXT$= "Error! Hit spacebar to continue."
0020 STARS$=" ***** "
0030 BLANKS$=STRING$(LEN(TEXT$)," ")
0040 IF INP(1)<> 13 THEN GOTO 100
0050 IF I=0 THEN MIDDLE$=TEXT$ ELSE MIDDLE$=BLANKS$
0060 I=I XOR 1
0070 FOR J = 1 TO 300: NEXT J    'Delay Loop
0080 PRINT STARS$+MIDDLE$+STARS$;CHR$(13);
0090 GOTO 40
0100 PRINT:PRINT "Out of Loop"
```

Listing 1. Blinker routine.

```
0001 ' I is the value which will cycle thru the pattern.
0002 ' J is the mask with which I is XORd to change it.
0003 ' K is the mask with which J is XORd to flip it.
0010 INPUT I,J,K
0020 PRINT "J VALUE = ";J
0030 PRINT "K VALUE = ";K
0040 PRINT "STARTING VALUE OF I";I
0050 PRINT
0060 PRINT "CYCLE IS"
0070 FOR Z=1 TO 8
0080 J=J XOR K: I=I XOR J
0090 PRINT I;
0100 NEXT Z
0110 PRINT
0120 GOTO 10

Input values        Sample results
I=0, J=1, K=1       0,1,1,0,0,1,1,0
I=1, J=1, K=1       1,0,0,1,1,0,0,1
I=0, J=0, K=1       1,1,0,0,1,1,0,0
I=1, J=0, K=1       0,0,1,1,0,0,1,1
```

Listing 2. Double XOR loop.

In the November 1980 issue of *Microcomputing*, Alan Sclawy described an encryption scheme based on the use of the XOR function ("CP/M Encryption Prescription, p. 42). This same function can be used in some other interesting ways. For instance, you can use XOR to "flip a switch" back and forth, so that the program will first do one thing, then a second thing, then the first again, then the second again, and so on indefinitely.

XOR stands for Exclusive OR. It is one of the less-used Boolean operations. It is generally, if unclearly, explained as "either A or B but not both." For example:

A	B	A XOR B
1	1	0
1	0	1
0	1	1
0	0	0

In each case, if either A or B is 1, and the other is 0, the result is 1, but if A and B are the same—either both 1's or both 0's—the result is 0.

This doesn't seem particularly useful. But as Sclawy points out, there is another way to look at this operation. The effect of this operator is that if the B bit is 1, the A bit is flipped to its opposite state, while if the B bit is 0, the A bit is unchanged. We can consider the B bit—or, for that matter,

Address correspondence to Allan D. Pratt, Graduate Library School, University of Arizona, Tucson, AZ 85721.

the entire byte to the right of the XOR operator—as a selective mask. Now, consider what happens when you XOR an eight-bit byte with itself. Using 1 for an example, we have:

```
Bit 7 6 5 4 3 2 1 0
    0 0 1 1 0 0 0 1 (ASCII code for digit 1)
    0 0 1 1 0 0 0 1 (Again, same pattern of bits)
XOR 0 0 0 0 0 0 0 0 (Result is all zeros)
```

Now, if we XOR this result with our original number again, we come back to that original number, thus:

```
Bit 7 6 5 4 3 2 1 0
    0 0 0 0 0 0 0 0 (Result after first XOR)
    0 0 1 1 0 0 0 1 (Pattern for digit 1)
XOR 0 0 1 1 0 0 0 1 (Result is back to original
                     value)
```

In BASIC, we could have

```
0010 X=X XOR 1
0020 PRINT X;
0030 GOTO 10
```

If we assume that X has not been assigned any previous value, and is therefore equal to zero, this will result in the printing of a continuous pattern of alternating 1's and 0's across the screen. This will work for any value up to 32767, in Microsoft BASIC at any rate. This value is one-half the maximum integer value the system can handle, so XORing it with itself will give all zeros. Any bigger number causes an overflow. If we XOR with 45, for example, instead of 1 in line 10, we will get a pattern of alternating 45s and 0's.

Applications

This flip-flop operation can be put to good use in a variety of ways. For example, it could be used in a text processor to alternately print page numbers on the right and left sides of the page. Another use is shown in Listing 1, in which XOR is used as a blinker control. This short routine demonstrates the printing of an error message which flashes until the operator takes some appropriate action.

The error message TEXT$ is printed on the screen, bracketed by asterisks. The MIDDLE$ of the printed line is alternately replaced by BLANKS$ or TEXT$, depending on the value of I (0 or 1), with a delay loop between cycles. The process continues to cycle until you hit any key except CR. The CHR$(13) instruction at the end of line 80 is a carriage return for the cursor. This, and the semicolon at the end, keeps the printing and blanking on the same line, rather than running it down the screen. Modifications of this general idea, by getting TEXT$ from a string array of error messages, or changing the operator's action and options as required, are fairly simple to invent.

This same idea can be used in computational programs. In some equations, for example, the sign of each term alternates. An instance of this is $(1+x)^{-1} = 1 - x + x^2 - x^3 + x^4 - \ldots$

You can create this alternating-sign effect easily with XOR. The brief program below demonstrates the effect of various simple combinations of numerical values which will cause these alternating patterns to appear:

```
10 INPUT A,B
20 FOR I=1 TO 8
30 A=A XOR B
40 PRINT A;
50 NEXT I
60 PRINT
70 GOTO 10
80 END
```

Some examples are:

A	B	Result
1	1	0,1,0,1,0...
0	1	1,0,1,0,1...
−1	−1	0,−1,0,−1,0...
0	−1	−1,0,−1,0,−1...
−1	−2	1,−1,1,−1,1...
1	−2	−1,1,−1,1,−1...

This XOR switching ability can be nested as well, to produce some more interesting patterns. You might, for example, want to execute some subroutine *twice*, then a second one twice, then the first one twice again, and so on. A pattern of alternating 0,0,1,1,... can be produced; or 1,1,0,0...; or 1,0,0,1...; or any of several other combinations.

Let I be the value which you want to cycle through the pattern. J is the mask against which I will be XORed. J is itself XORed against some constant, K, which will cause it to flip back and forth between two values. Since J flips between two values, I will vary over four different ones, though in some cases, there will be two values, which occur in pairs. The program in Listing 2 will let you experiment with various combinations of I,J and K.

One of particular interest is I=3, J=1 and K=2. This will result in 0,1,2,3,0,1,2,3 giving a four-beat cycle. This would allow the selection of four different subroutines in a recurring pattern.

It is possible to extend this notion further, with yet another nested XOR, but beyond two levels, keeping track of what is going on will become too complicated to be worth the trouble. To control over four options it is probably better to use a more conventional technique, such as a counter or a FOR-NEXT loop.■

✓See List of Advertisers on page 210

Here's a quick and easy hardware modification that puts the Bytesaver in its place.

A Spacesaver For the Bytesaver II

By George S. Losey

The Cromemco Bytesaver II is a handy S-100 memory board, but it does have limitations. On the positive side it can house and program up to 8K bytes of programmable read-only memory (PROM) and reside in any of eight memory banks. It can be selected for DMA (direct memory access) even when it resides in an inactive bank and is overlapped by another board in an active bank (as long as the other board also has DMA override features).

Unfortunately, the Bytesaver is also a memory hog. My Z-2 uses only 1K or 2K of PROM, but when those addresses are active, the entire 8K is active. The Bytesaver will drive the data bus high when any of the empty PROM sockets are addressed. If other memory occupies the same address, a bus conflict is created with disastrous results.

I was able to live with this minor inconvenience until I installed a Dataspeed disk controller. It has a PROM that demands exclusive use of 1K of memory at F000 (hex). The Cromemco monitor demands 1K at E000. Placing the Bytesaver in the highest page of memory to keep the monitor happy made it impossible to use the disk controller.

Address correspondence to George S. Losey, University of Hawaii at Manoa, PO Box 1346, Coconut Island, Kaneohe, HI 96744.

Since it does me little good to have a resident monitor that lives in an inactive memory bank, I set out to modify the board. The modification had to fulfill three goals. First, it had to be nondestructive. I hate cutting foils and then having to solder them back after discovering my supposed improvements only resulted in messing up a perfectly good board.

Since it does me little good to have a resident monitor that lives in an inactive memory bank, I set out to modify the board.

Second, it had to allow the Bytesaver to be switch-selected to occupy either an entire 8K page of memory or restrict itself to the lowest 1K region of the page. In this manner, it could house my 1K monitor and not interfere with the disk controller. I could then devote the remaining 6K of space to RAM by using a Thinkertoy Memory Master 16K board selected to have a 1K window for both the monitor and for the disk controller. Or, when desired, I could pop the top off the computer and select the entire 8K of PROM space.

Finally, I demanded that it be simple and cheap, since I spend too much time on this stuff anyway.

The modification I made costs about $1, takes 20 minutes to complete and fulfills all of my goals. It uses an SPST switch (switch 8, ADDR/CONTROL bank) and two 74LS00 gates (IC1). In its simplest form it adds one restriction: The DMA OVERRIDE and DMA IN/OUT switches can't both be on when the special 1K ONLY option is selected. This causes a few problems and is discussed fully below.

Before going any further, you should correct an error in the July 1, 1979, Bytesaver II manual. If your board is like mine (revision C), your manual may well be wrong. The person who drew the schematic, revision 3 (p. 26 of the manual), was right on target; but whoever drew the figures in part II was confused. The DMA OVERRIDE and DMA IN/OUT

MTU Introduces The Complete Desktop Computer

The MTU-130™ computer is THE COMPLETE 6502 system. This desktop system is designed for people who need to maximize their computing and minimize their learning time. It gives you the features you need to perform your applications.

A desktop computer should have clean expansion beyond the standard system. The MTU-130 is designed with an 18 bit address bus for up to 256K memory (80K standard) and includes an internal card cage for expansion boards or your own custom boards when needed. Of course, the power supply and fan have sufficient capacity for expansion. We even have provided rear panel cutouts for custom connectors if you need them for that special task you have to perform.

The human interface features of this system include: a 96 key keyboard with programmable function keys and displayed soft legends, a bit mapped display with 480 x 256 pixel resolution graphics, 80 column text (gray scale also), an 8 bit audio port for speech, music and sounds, and a high speed (60 points/sec) fiber optic light pen. Other standard I/O includes 2 parallel ports with handshaking and a serial port with software selectable 50-19.2K baud-rates. Of course connectors are provided on the rear panel.

You interact with the MTU-130 through our field proven Channel Oriented Disk Operating System (CODOS) which permits you to easily customize your system. Using CODOS™, any file is transferred from disk to anywhere in memory at a sustained speed of 19.6K bytes/second (not burst speeds!). Files are handled automatically, freeing you to perform at your peak. Auto-execution of "jobs" when power is turned on can turn the MTU-130 into a dedicated-function system. A monitor with 32 commands and 19 utilities is standard. Text or data can be easily transferred to or from other systems on IBM or CP/M* (or others) format disks with our optional DISKEX™ program.

Our standard full screen EDITOR allows you to edit text or program files with rapid positioning anywhere in the file. It edits any file size that fits on the disk (not just in memory) and will edit a file in place or save a backup copy. The concept "what you see on the display is what exists in the file" has been employed which significantly reduces your learning and interacting time. This is a very powerful tool usable by anyone.

If your needs include software development, you will find our optional MOS Technology compatible ASSEMBLER and DISASSEMBLER extremely fast, significantly reducing your development time. For example, a 210K byte source program with 6300 lines and 800 symbols can be assembled in less than 4 minutes. This includes generating the object file and the listing with sorted symbol table and cross reference map on disk. This can be accomplished on a standard 1-drive MTU-130-1S.

If you prefer to program in high level languages, keep in mind that the MTU-130 is RAM-based, not ROM-based, giving you the maximum memory possible for the use with any language. Our version of MICROSOFT BASIC is standard with MTU-130 systems. It allows libraries of commands to be added when needed such as our Virtual (floating point) Graphics. PASCAL and FORTH are planned.

The base standard MTU-130-1S system comes with one single-sided, double-density 8″ floppy disk, a 12″ green phosphor CRT, and MTU-BASIC for $3995. The 3 other models contain 1 or 2 single or double sided drives priced up to $4995 for 2 Megabytes of storage. You can choose an MTU-130 without disk drives, languages or CRT for $2640. 4 Megabyte systems available on request.

We obviously cannot describe fully all of the details of the MTU-130 in this advertisement. If you want to know more about this complete desktop computer, call or write for our complete 28 page descriptive literature. International requests include $5.00 U.S.

COME TO MTU - for excellence in microcomputing systems.

*CP/M is a trademark of Digital Research.

MTU ✓154

Micro Technology Unlimited
P.O. Box 12106
2806 Hillsborough St.
Raleigh, NC USA 27605
(919) 833-1458

switches in the ADDR/CONTROL bank are reversed in figures 2, 3, 4 and 10. Switch No. 2 is the DMA IN/OUT and switch No. 3 is the DMA OVERRIDE. DMA does not work very well unless you change these figures.

Keep It Low

The key to the modification is to keep the board enable signal from going high unless bus address signals, A10, A11 and A12 are all low; i.e., unless the lowest 1K PROM is addressed. Board enable is a wired AND of several lines. If one of the several inverter gates is kept low, board enable remains low.

The simplest approach that I could find is to keep the NAND output at pin 3 of IC 1 high. I used the unused switch (no. 8) in the ADDR/CONTROL switch bank (renamed as the 1K ONLY switch), one of the unused NAND gates in IC 1, and two OR gates in a 74LS32 that was added to the board. In the circuit shown in Fig. 1, the OR gates decode A10, A11 and A12 and drive the extra NAND. The NAND, when the 1K ONLY switch is closed (on), holds input pin 1 on IC 1 low when any of the three address lines are high. This causes pin 3 of IC 1 to remain high and board enable to remain low. When the 1K ONLY switch is open (off), the entire 8K board is addressed.

Note that when the 1K ONLY switch is closed, if both the DMA IN/OUT and DMA OVERRIDE switches are closed, the 74LS04 inverter is placed in a wired AND with the 74LS00 gate that has been added. This is a no-no with totem pole outputs, so this board should never be configured with all switches closed. However, the only time that both DMA switches are closed is when the board is residing in an inactive memory bank but is to be selected for DMA addressing during a read. One would rarely want to perform a DMA read from a PROM. If this was needed, the 1K ONLY switch might as well be open at any rate since the board is not selected.

I decided that having a potentially dangerous switch combination was less evil than cutting foils to modify the circuit. If you decide that you don't mind cutting foils, a solution is at hand that demands only three additional resistors (Fig. 2). First, a 74LS33 must be used in place of the 74LS32 used above. The two extra OR gates are used as buffers in order to implement a wired AND. Pull-up resistors must be added to the OR gates used to decode A10, A11 and A12. The foil connection between pin 4 of RN2 and pin 1 of IC 1 is severed. Pin 4 of RN2 is led to both inputs of one of the extra OR gates, and the output from the 1K ONLY switch is led to both inputs of the other extra OR gate. The outputs of both OR gates are placed in common as a wired AND with a 1k, 1/4 watt pull-up resistor and connected to pin 1 of IC 1. The wired AND is now implemented and you can fiddle with the switches to your heart's content.

Construction of the modification can be done without cutting foils. A 1/2-inch × 3/16-inch chip of plexiglass is epoxied to the component side of the board with a 14-pin socket epoxied to it so that the soldering pins do not contact the board. Run a few lengths of wire-wrap wire through convenient holes on the board and solder in place. Be careful not to damage the insulation on these wires where they lead through these holes. The holes are plated through connections, and shorts could lead to very uninteresting results. The modified board has the same vertical clearance as the original board and can fit into a tightly packed S-100 bus.

If you have some time on your hands and desire a fancier solution, a more complex circuit could put any combination of the eight PROMS out of commission. An additional 74LS42 (1 of 8 decoder), eight 74LS36 (exclusive OR gates) and a bank of eight switches would be required. The A, B and C inputs of the 74LS42 are connected to the A10, A11 and A12 bus inputs. The D input of the 74LS42 must be tied to ground. The switches and exclusive OR gates are then connected, similar to the existing A13, A14 and A15 logic. The exclusive ORs are then all connected with a 1k pull-up resistor in a wired AND. The wired AND output is then used in place of the OR output in the previous solution. Note that you cannot use the existing 74LS42 for this purpose. The D input for this chip is generated by board enable—your board would never be enabled.

I have used my modified board at both 2 and 4 MHz speeds without any problem. This spacesaver for the Bytesaver II works well. ■

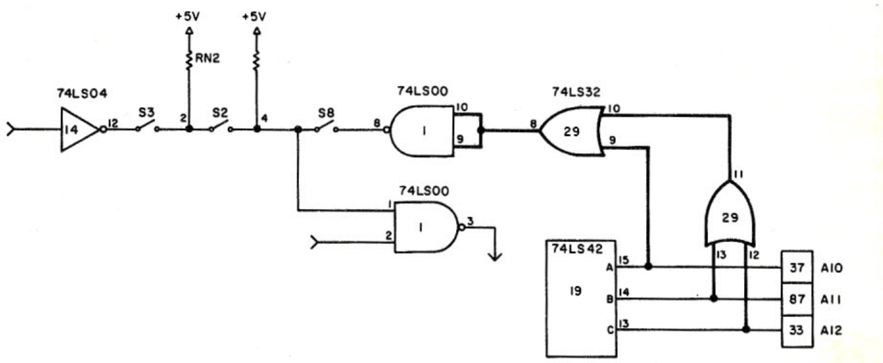


Fig. 1. Schematic for Bytesaver II modification. ICs 1, 14 and 19 correspond to the factory schematic. Bold lines indicate the added IC 29 and its connections. With this circuit, if switch 8 is closed, the DMA IN/OUT and DMA OVERRIDE switches cannot both be closed at the same time.

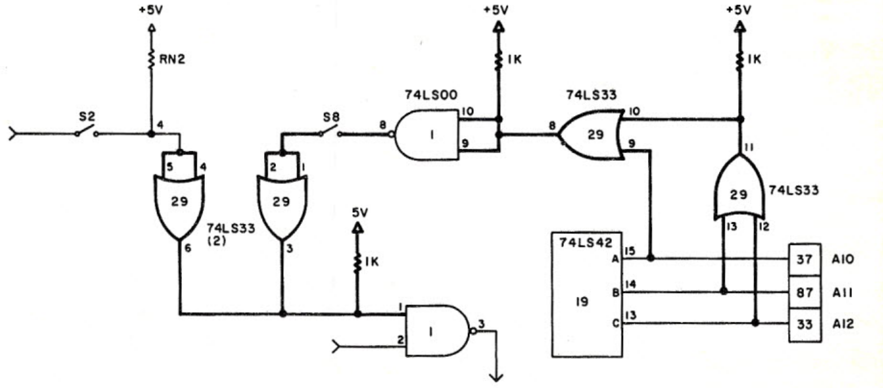


Fig. 2. Schematic for alternate Bytesaver II modification. This circuit lacks the switch closure restrictions of the circuit in Fig. 1. The factory-printed connection between pin 4 of RN2 has been severed. Bold lines indicate added parts (IC 29 and three 1/4 W resistors) and their connections.

DEALER DIRECTORY

El Monte, CA
Ohio Scientific specialist in the San Gabriel Valley serving greater Los Angeles. Full product line on display. Specializing in business computers. In-house service. Custom programming. Terminals. Printers. Open Mon–Sat, 9 AM–7 PM. **Computer & Video, 3380 Flair Dr., Suite 207, El Monte, CA 91731. 572-7292.**

N. Hollywood, CA
Wholesale prices to dealers & computer club members! Anadex, Centronics, Corvus, Delta, Diablo, Epson, Godbout, Hayes, IDS, C. Itoh, Micro Pro, Mountain Computer, NEC, Novation, Okidata, Qume, TI, Televideo, Vector Graphic, Vista, Zenith & others. **Patio Computer Sales Co., Suite 204, 5451 Laurel Canyon Blvd., N. Hollywood, CA 91607. 762-0020.**

Riverside, CA
Visit our Computer Support Center for the Inland Empire's largest selection of ICs, books and computer accessories. Open daily. Check our prices and friendly service. **Inland Electro-Mart, 8624 California Ave., Riverside, CA 92504. 687-3776.**

San Jose, CA
New and used computer products—specializing in S-100 boards, printers, drives, chasses and complete systems, as well as supplies and parts—Imsai, Tandon, Diablo—5000 sq. ft. **W/W Component Supply, Inc., 1771 Junction Ave., San Jose, CA 95112.**

San Jose, CA
Bay area's newest computer software store. Featuring Instant Software for the TRS-80, Apple, magazines, books. **Shaver Radio, 1378 S. Bascom Ave., San Jose, CA 95128. 998-1103.**

Gainesville, FL
Florida's most knowledgeable computer dealer. Apple computer (and S-100) sales and service. Peripherals, books, magazines, software, classes, consulting, supplies and engineering. **Computer System Resources, Inc., 3222 SW 35th Blvd., Gainesville, FL 32608. 376-4276.**

Melbourne, FL
Sales, service and leasing for Apple, SD systems, Altos, Atari, Mountain Computer, Intersystems, Epson, Anadex and Paper Tiger. Software, books, and magazines. Systems consulting. Mail order. **H.I.S. Computermation, Inc., 1295 Cypress Ave., Melbourne, FL. 254-9399.**

Nokomis, FL
We are the leading area computer store. We carry Cromemco, Apple, Vector Graphic; printers & terminals. We offer full software support including G/L, A/R, payroll & word processing. **Computer Centre, 909 S. Tamiami Trail, Nokomis, FL 33555. 484-1028.**

Sarasota, FL
Your personal and business computer store for Dynabyte, Vector, HP-85, Atari and Epson. Structured Systems and Micro-Pro software. Computer furniture and books by Osborne or Hayden. Sales, service and supplies. **Computer Crossroads, 3800 S. Tamiami Trail, Sarasota, FL 33579. 349-0200.**

Aurora, IL
Microcomputer systems for home or business; peripherals, software, books & magazines. Apple, Hewlett-Packard Series 80 Systems, HP Calculators, IDS, Qume, Starwriter printers. **Farnsworth Computer Center, 1891 N. Farnsworth Ave., Aurora, IL 60505. 851-3888.**

Herington, KS
Hardware support. Maintenance and service for all microcomputers and peripherals. Kits assembled or debugged. Radio Shack (mods OK) repaired. Quality work, fast turnaround and reasonable cost. **Prairie Micro Clinic, Box 325, Herington, KS 67449. 258-2179.**

Pasadena, MD
Altos, Apple, Osborne, Atari—systems, software, service. Not just another computer store! We're a full-service problem solving center for small businesses. **Computer Crossroads, Inc., 9143G Red Branch Rd., Columbia, MD; 8220 Ritchie Hwy., Pasadena, MD. 730-5513/647-7111.**

Garden City, MI
Books, magazines, hardware and software for Apple, North Star, TRS-80 and PET. **Computer Center, 28251 Ford Rd., Garden City, MI 48135. 425-2470.**

Lodi, NJ
Computer hardware: North Star, Zenith, Atari, CBM/PET, Qume, Epson and others. Software: EduWare, Professional Software, Zenith, North Star, Programma, Personal Software and others. Factory trained service dept. Books, magazines, etc. Full product line on display. **Comtek Electronics, Inc., Rt. 46 West, Lodi, NJ. 472-2440.**

River Edge, NJ
Discount software—up to 25% off business, utility, recreational, educational and home programs. Apple, Atari, TRS-80 and PET. Atari computers always on sale. **Software City, 111 Grand Ave., River Edge, NJ 07661.**

Chautauqua, NY
Retail book store featuring the Disassembled Handbook for TRS-80 Volumes 1, 2, 3. English, German & French language editions. 9 AM–5 PM weekdays. Come and visit us. **Richcraft Computer Book Store, 1 Wahmeda Ave., Chautauqua, NY 14722. 753-2654.**

Rome, NY
New and experienced computers, printers, modems. Software exchange. VHS video equip., blank tapes, rated movies. List includes (send SASE): PET, SSB, TRS-80, SWTP, Panasonic, VCX. **Video Computer Center, Box 1285-408, W. Liberty St., Rome, NY 13440. 336-0266.**

Staten Island, Brooklyn, NY
Computer hardware: North Star, Zenith, Atari, CBM-PET, Qume, Epson and others, Software: EduWare, Professional Software, Zenith, North Star, Programma, Personal Software and others. Factory trained service department. Books, magazines, etc. Full product line on display. **Comtek Electronics Inc., Staten Island Mall, Staten Island, NY. 698-7050; Coney Island Ave. and Ave. X, Brooklyn, NY. 332-5933.**

Mississauga, Ontario
I.D.S. brings Digital Research's Big Board into Canada. Bare boards, kits, or fully assembled single board computers plus many CP/M based business and utility software. **Innotech Digital Systems, 50 Elm Drive East, Suite 1804, Mississauga, Ontario, L5A 3X2, Canada. 277-2222.**

Portland, OR
Ohio Scientific specialists for business and personal computers. Local service. Terminals, printers, custom programming. Full OSI product line on display! 10 AM to 6 PM M–F. **Fial Computer, 11266 SE 21st Ave., Milwaukie, OR 97222. 654-9574.**

Montreal, Quebec
We do expert service on all microcomputers and peripherals, (CRT, printer, floppy disk) North Star, Hazeltine, Cromemco, Centronics, Shugart, Siemens, Apple, TRS, Epson, S-100. **Montreal Data Centre, 120 Ricard, Legardeur, Montreal, Quebec. 585-8801.**

Woodbridge, VA
Computer/word-processing systems for business, school, home. Software, disk drives, printers. Books, magazines, supplies. Authorized CBM/PET dealer, service. Consulting, training, maintenance contracts. MWF noon-8 PM, Saturday 9 AM-3 PM. **Virginia Micro Systems, Inc., 14415 Jefferson Davis Highway, Woodbridge, VA 22191. 491-6502, Washington Metro 643-1063.**

Spokane, WA
SS-50 Users: Expand present system to maximum or build from ground up. We provide PCBs for motherboards, interfaces, etc. Write for specs and information. **Quality Research Company, PO Box 7207, Spokane, WA 99207.**

Tell your dealer you saw this ad in Kilobaud Microcomputing.

Dealers: Listings are **$15** per month in prepaid quarterly payments, or one yearly payment of **$150**, also prepaid. Ads include 25 words describing your products and services plus your company name, address and phone. (No area codes or merchandise prices, please.) Call Marcia at 603-924-7138 or write *Kilobaud Microcomputing*, Ad Department, Peterborough, NH 03458.

PRICE BREAKTHROUGH
16K RAM BOARDS FOR APPLE JUST $129.95

HAVE YOU BEEN WAITING FOR THE COST OF EXPANSION BOARDS TO COME DOWN? YOUR WAIT IS OVER. UP UNTIL NOW RAM EXPANSION HAS COST AS MUCH AS $195.00. NOW **OMEGA MICROWARE** IS PROUD TO ANNOUNCE THE ARRIVAL OF A TRULY AFFORDABLE EXPANSION CARD.

NOW YOU CAN RUN **PASCAL, FORTRAN, 56K CPM** WITH **A** Z80 **SOFTCARD, INTEGER BASIC, APPLESOFT AND OTHER LANGUAGES** ON YOUR **APPLE.** NOW YOU CAN **INCREASE USUABLE MEMORY** FOR **VISICALC.** NOW YOU DON'T HAVE TO PAY A FORTUNE TO HAVE ALL THIS.

AT $129.95, **OMEGAS RAMEX** 16 IS THE LOWEST PRICED CARD AVAILABLE TODAY.

WHAT DO YOU GIVE UP WHEN YOU PURCHASE THIS FIRST REALLY AFFORDABLE **RAM** EXPANSION CARD? WELL, YOU GIVE UP HAVING TO REMOVE ONE RAM CHIP FROM THE MOTHER BOARD OF YOUR **APPLE.** YOU GIVE UP HAVING TO STRAP A CABLE FROM THE CARD TO YOUR MOTHER BOARD. THAT'S IT. WHAT YOU GET IS A SIMPLE, RELIABLE, BOARD THAT JUST PLUGS IN. MEMORY REFRESH IS ACCOMPLISHED ON THE BOARD ITSELF.

THE **RAMEX** 16 IS GUARANTEED NOT JUST FOR 90 DAYS. NOT EVEN 6 MONTHS. OUR **WARRANTY** IS FOR **ONE FULL YEAR** FROM DATE OF PURCHASE. WE WILL REPAIR OR REPLACE ANY BOARD THAT IS DEFECTIVE THROUGH MANUFACTURE FOR A PERIOD OF ONE YEAR AFTER PURCHASE PROVIDED THIS DAMAGE IS NOT USER INFLICTED.

ORDER YOUR **RAMEX** 16 NOW BY CALLING **TOLL FREE** 1-800-835-2246. **KANSAS RESIDENTS CALL** 1-800-362-2421. MASTERCARD OR VISA ACCEPTED OR SEND $129.95. ILLINOIS RESIDENTS ADD $7.80 SALES TAX.

ANOTHER QUALITY PRODUCT FROM
OMEGA MICROWARE, INC. ✓201
FORMERLY OMEGA SOFTWARE PRODUCTS, INC.
222 SO. RIVERSIDE PLAZA
CHICAGO, IL 60606
PHONE 312-648-1944

©OMEGA MICROWARE, INC.

APPLE AND APPLESOFT ARE REGISTERED TRADEMARKS OF APPLE COMPUTER, INC. PASCAL IS A REGISTERED TRADEMARK OF THE REGENTS OF THE UNIV. OF CA. SAN DIEGO. VISICALC IS A REGISTERED TRADEMARK OF PERSONAL SOFTWARE. CPM IS A REGISTERED TRADEMARK OF DIGITAL RESEARCH INC. Z80 IS A REGISTERED TRADMARK OF ZILOG, INC. SOFTCARD IS A REGISTERED TRADMARK OF MICROSOFT.

Dear Microcomputer User:

Although we are based in "no sales tax" New Hampshire, many of you from all over the United States have stopped by during the last four years.

Whether it was an Apple, IBM, or other personal computer that you purchased, we're glad we could help provide a solution for your needs. We hope you'll call on us again.

We thank you.

ComputerLand® ✓228
419 Amherst St., Nashua, NH 03063
603/889-5238

CLUB NOTES

Japanese Computer Clubs

Japanese computer clubs wish to contact U.S. clubs to exchange ideas, software, etc. Please send information including club name, size, when formed and type of activity to ORII, PO Box 1358, Mountain View, CA 94042.

Fairfield, CT TRS-80

The Fairfield County TRS-80 User's Group meets on the first Tuesday of every month at 7:30 PM at the New Canaan Country School.

Contact Fairfield County TRS-80 User's Group, Alan Abrahamson, 10 Richlee Road, Norwalk, CT 06851. 203-866-2670.

Northeastern Ohio Heath User's Group

The Northeastern Ohio Heath User's Group (NOHUG) meets the second and fourth Thursday each month from 7–9 PM at the Maple Heights Public Library (Cleveland suburb). Persons desiring information about the club and/or membership should contact Art Petkosek, 4705 Tanglewood Pl., Lorain, OH 44053.

The Philadelphia Area Computer Society

The Philadelphia Area Computer Society meets in the LaSalle College Science Building at the corner of 20th and Olney Ave. The society has many user's groups including Apple, Atari, CP/M, Ohio Scientific, Pascal, PET, and TRS-80. Membership applications should be sent to The Data Bus, PACS, Box 1954, Philadelphia, PA 19105. 215-925-5264.

Northwest Computer Society

The Northwest Computer Society meets in the Lemieux Library Auditorium, room 115, Seattle University, the first and third Thursdays of each month at 7:30 PM. Membership in the Society is open to anyone interested in personal and small business computers. For more information write Northwest Computer Society, PO Box 4193, Seattle, WA 98104.

Chicago TRS-80 User's Group

The Chicago TRS-80 User's Group meets the third Wednesday of every month at 203 N. Wabash, Room 110, Chicago, IL, at 6 PM. TRS-80 users are invited to attend.

DAInamic

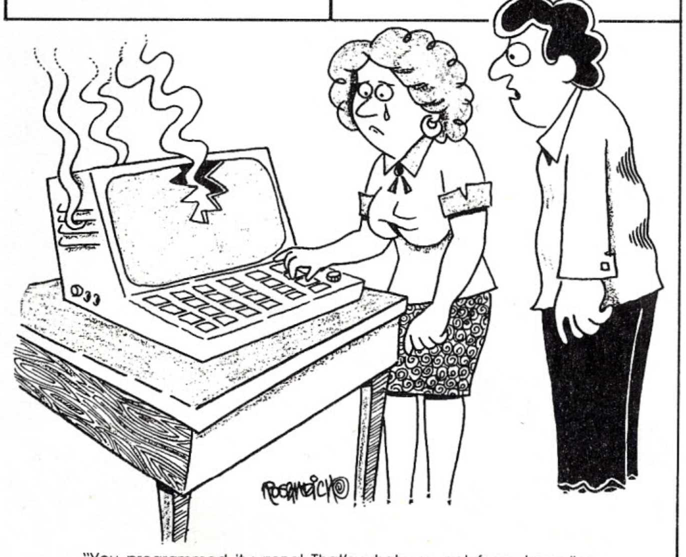
DAInamic is a DAI personal computer user's group based in Belgium. The group has over 500 members in Belgium, Holland, Germany and France. They publish a bimonthly newsletter with articles in English.

For more information contact DAInamic, Heide 98, 3171 Westmeerbeek, Belgium.

Denver Amateur Computer Society

The general meeting of the Denver Amateur Computer Society meets the third Wednesday of every month at 7 PM at the Educational Plaza, 7350 N. Broadway (intersection of I-25 and Boulder Turnpike).

For more information contact DACS, PO Box 1235, Englewood, CO 80150.



"You programmed it wrong! That's what you get for not reading Kilobaud Microcomputing!"

CLASSIFIEDS

Classified advertisements are intended for use by persons desiring to buy, sell or trade used computer equipment. No commercial ads are accepted.

Two sizes of ads are available. The $5 box allows up to 5 lines of about 35 characters per line, including spaces and punctuation. The $10 box allows up to 10 lines. Minimize use of capital letters to save space. No special layouts allowed. Payment is required in advance with ad copy. We cannot bill or accept credit.

Advertising text and payment must reach us 60 days in advance of publication (i.e., copy for March issue, mailed in February, must be here by Jan. 1). The publisher reserves the right to refuse questionable or inapplicable advertisements. Mail copy with payment to: **Classifieds, Kilobaud Microcomputing, Peterborough, NH 03458.** Do not include any other material with your ad as it may be delayed.

For sale: SMD 13-inch color monitor $475. Apple silenttype printer w/2 rolls of paper $375. C1P w/8K RAM $300. Will bargain. Mike Kirk, 1205 Washington, Friona TX, 79035.

SWTP 6809, 56K, MP-S, MP-LA, 1.5 MHz, $950. Dual 5.25-inch drives, PS, cabinet, $475. SWTP DC-4 DD ctlr w/FLEX9, TSC BASIC, tForth, Pascal, Sleuth, $325. SSB DC-A ctlr with DOS68.51C, CSS BASIC, Fortran, $250. Percom SBC/9, $90. More: 817-461-2239. C. Shilling, Arlington, TX.

For sale or trade: S-100 boards, ICs, power supplies, magazines, too many to list here. S. Rajabzadeh, 2666 Paganini Ave., San Jose, CA 95122. 408-238-2969.

Hewlett-Packard HP-85 (32K) w/ROM drawer, I/O ROM, printer/plotter ROM, RS232, ccase, VC+ $3950. V.M. Faulkner, 317-289-4138.

For sale: 32K Exidy Sorcerer $700. BASIC and development PACs each $50 extra. Comprint printer $350. R.L. Henne, 5870 Wood Flower, Burke, VA 22015. 703-250-5323.

For sale: Centronics P1 printer, perfect condition, rarely used, 4 rolls of paper, paid $430, asking $200 or best offer. Philip Baily, 4758 Kinglet, Houston, TX 77035. 713-729-6290.

Heathkit H89. Fully assembled with one drive, 48K memory and HDOS operating system. Expertly built and tested by member of *Kilobaud Microcomputing* staff. Featured on cover of March 1981 issue. Perfect condition. $1995. Jeff DeTray, 603-525-4998, evenings.

For sale: SWTP PR40 printer w/case of paper $125. Xitex video terminal, ex. $100. 2 SWTP 4K mem. bds. $50 ea. Execuport printer terminal modem $250. 2 keyboards $10 ea. 2 MPI 8-inch disk drives w/factory manual, $175 ea. or trade for 5-inch drives. Need an SWTP Mpa2 card. Warren V. Bell, 1604 N. Smith St., Spokane, WA 99207. 509-534-8088 eves., PST.

For sale: 2114L2 memory chips, new—never used. All or part, $2.65 each. R. Van Cleave, 256 S. Tucson Circle, Aurora, CO 80012. 303-340-2955.

For sale: Diablo 1640KSR daisywheel printers, one new and one used, $2150 and $1950. TRS-80 printer III, used, $1200. San Jose, CA, call Chris 415-494-4557.

Free machine-language monitor for Elf II. Does all that the Netronics monitor does plus more and uses the terminal, not the hex keypad. Runs in 1.25K and can run from a PROM. Has a 300 baud software UART and a parallel printer out routine. Please send name and address with $2 to cover reproduction and mailing to: John Ware, 2257 6th Ave., Ft. Worth, TX 76110.

Japanese computer clubs wish to contact U.S. clubs to exchange ideas, software, etc. Please send information including club name, size, when formed, type of activity, etc., to ORII, PO Box 1358, Mountain View, CA 94042.

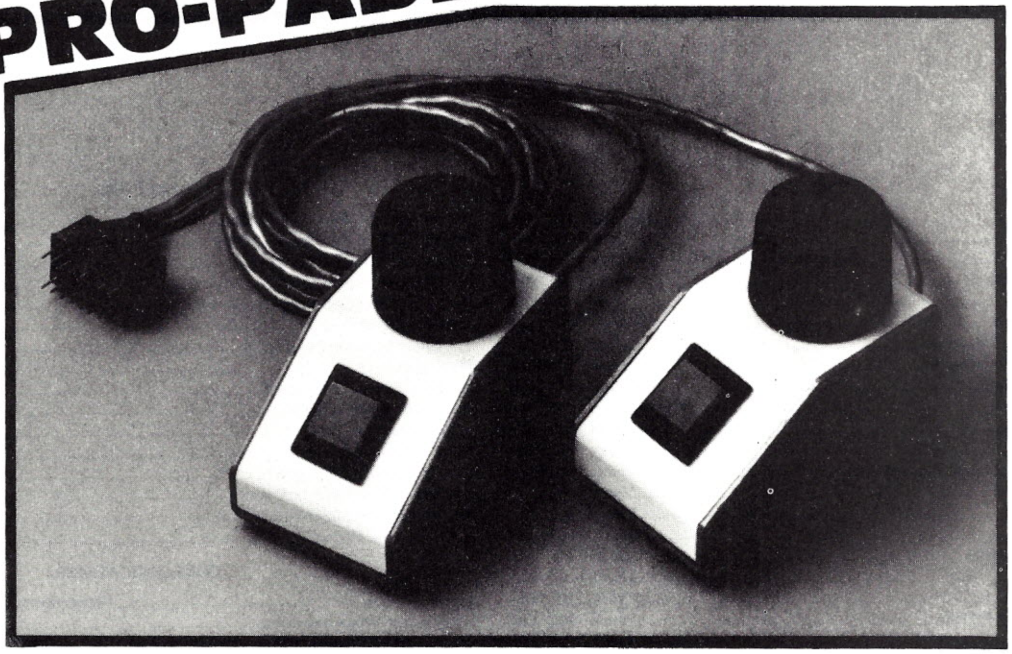
For sale: Radio Shack LP(I)-Centronics 779 printer. Matrix-type with adjustable forms tractor. Unit just upgraded by Centronics. Like-new cond. $465. C. Okstein, 6 Storrs Rd., Willimantic, CT 06226. 203-487-1616.

Magazines: Wanted—*Interface Age:* Dec '75, Jan '76, Feb '76, Mar '76, Sept '76, Dec '76, Mar '77, Apr '77; *Byte*: Feb '77. Any condition, will pay top dollar for good condition. For Sale—*Byte*: July '76, Aug '76; *Dr. Dobb's*: Apr '77, Jan '78, May '78—$2.00 each. Call Andy Beck 201-370-9889 days, 370-9568 evenings or write PO Box 571, Jackson, NJ 08527.

For Sale: PET 8K with modem, joysticks, four voice music interfaces, and 150 programs. $1100 or best offer, plus shipping. Will cut price for high resolution color monitor. Call or write Rick Lucas, 12360 Kayla Lane, Houston, TX 77015. 713-455-5390 or 713-453-2174.

Rainbow Computing, Inc.
Announces!

PRO-PADDLE



For the Apple® II Computer

PRO-PADDLE is the only heavy-duty paddle available for the Apple II. It features compact sturdy metal construction, long-life switches with large buttons and tactile feedback, high accuracy paddle movement, shielded coaxial cables, and a molded plug. These paddles are designed and built by Computerworks and are constructed of the highest quality materials and workmanship available.

End your paddle problems for good! $39.95

Add Shipping $2.50 U.S. and $10.00 Foreign

Dealer inquiries invited.

Our catalog contains many more products for your Apple Computer. Please request a FREE catalog with your purchase. If you only want a copy of our catalog at this time, please send $2.00 for shipping. Thank you.

*Apple is the registered trademark of Apple Computer Inc.

RAINBOW COMPUTING INC.

Mail Order Dept. KB12
19517 Business Center Drive
Northridge, CA 91324
Telephone: (213) 349-0300

1981 INDEX

APPLE

APPLICATIONS

ATARI

BUSINESS

COMMUNICATIONS

CONSTRUCTION

EDUCATION

ELF

ENCRYPTION

EXIDY SORCERER

GAMES

GENERAL INTEREST

GRAPHICS

HARDWARE REVIEW

HEATH

INTERFACING

KILOBAUD KLASSROOM

MEDICAL

✓See List of Advertisers on page 210

THE UNIVERSAL ON-LINE REFERENCE WORK

LOOK UP:

- Philip of Macedonia • Current stock prices
- Origins of Indo-European languages
- What's happening in Poland
- Martin Luther's 95 Theses
- Latest developments in Bubble Memory

Starting now, there's no reason to settle for dusty, moldy books as sources of information. Look it up in the Kussmaul Encyclopedia TM instead! Standard system includes:

- TRS80 16K Color Computer
- LEX 11 or Direct Connect Modem
- CTR80A Tape Data Recorder
- Software for games, finance and terminal emulation
- Access to 4 data base systems including The EncyclopediaTM data base.

ALL for $895 (Check, VISA, MC or combination).
TRS80 is a TM of Radio Shack/LEX 11 is a TM of Lexicon Corp.
"Encyclopedia" is a TM of General Videotex Corp. for its information retrieval system.

the KUSSMAUL Encyclopedia™
✓392

A Product of
General Videotex Corp.
377 Putnam Ave., Cambridge, MA 02139
Telephone: (617) 491-3393

Converse with your Computer
ELIZA
Play it — Program it

More than just a computerized "psychiatrist," this **new expanded implementation of ELIZA**, the world-renowned artificial intelligence demonstration program, brings to your micro the full capability of the original — and then some.

ELIZA converses with you in plain English, responding to your comments. Plus, it lets you modify its responses, and add new phrases to its repertoire. You can even create an entirely new set of conversational gambits on any topic you choose.

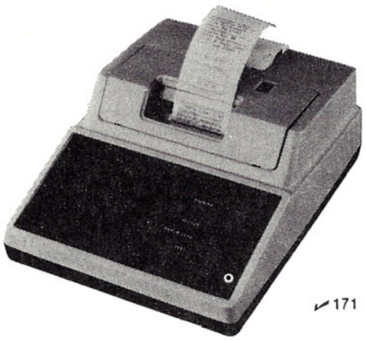
ELIZA comes with the original non-directive psychiatrist "script" developed at MIT. Documentation includes a copy of the original research paper, plus full instructions on how to program ELIZA's responses.

ELIZA requires 40K RAM and costs only $24.95.
Specify: 8" **CP/M** disk
5" Heath/Zenith disk

Add $3 shipping and handling, $2 for 5" disks, $5 for overseas. CA residents add sales tax.

The Software Toolworks

14478 Glorietta Lane ✓357
Sherman Oaks, CA 91423
(213) 986-4885
Circle reader service number for complete catalog.



✓171

Dot Matrix Printer Interfaces with Apple II
Featuring an Apple II®-compatible parallel interface, Addmaster Corporation has produced a new dot matrix printer, Model 170. The interface includes a Centronics-type handshake and DB-25 interface connector, Baudot, and day — and time clock. The Model 170 provides 18 or 21 characters per line, 6 lines per inch print density, on standard 2½" adding machine tape. Designed to use with personal computers, Model 170 will produce hard and carbonless copies of programs, data or results. **Write Addmaster Corporation, 416 Junipero Serra Dr., San Gabriel, CA 91776 or call 213/285-1121.**

VECTOR
GRAPHIC USERS

SAVE TIME!!! on every backup and format operation.

With our new **TURBOCHARGED™ BACKUP**, copy and verify your System B diskettes in only 60 seconds instead of 3 min 20 sec. Or your 2600 diskettes in 3 min 40 sec instead of 6 min 20 sec.

Available for system B's and 2600's

$45

Ask for our catalog of software products for Vector Graphic computers.

Modern Software Design ✓364
18590 Ventura Blvd, Suite 202
Tarzana, CA 91356
(213) 343-2083

No. 4
UNBELIEVABLE OPPORTUNITY!

You've Written a Fantastic Game? Then We'd Like to Publish It!

We're looking for hot GAME programs:

- **ARCADE (HI-SPEED GRAPHICS)**
- **ADVENTURE FORMAT**
- **FANTASY WARGAMING**
- **BOARD GAMES**
- **LOGIC & PUZZLE GAMES**

There's Gold in them there Games! Write for our free Programmer's Kit today.

INSTANT SOFTWARE, INC. ✓75
Submissions Dept.
Peterborough, NH 03458

SUPER MEMORY SALE

4116-250nS	8/15.95
4116-200nS	8/19.95
4164-200nS . . 22.50 ea.	8/152.00
2114L	8/19.95
2708 EPROM	3.75
2716 EPROM	6.95
2732 EPROM	17.95
2764 EPROM	67.00
Z6132	24.95

4K x 8 Quasi-Static RAM

SPECIAL ORDER LINE
1-800-521-0664
Write for Our Full Line Catalog

WESTLAND ELECTRONICS
37387 Ford Rd.
Westland, MI 48185
✓45

VISA MasterCard

CHIPS & DALE
Specializing in memory Chips

THE INFLATION FIGHTERS!

By carrying a Specialized Product Line; we are able to get large discounts through volume buying. These savings are passed on to you!
***We buy from Manufacturer's Authorized Distributors. All Chips are fully Guaranteed.**
***Also we won't carry any quality product unless we're able to provide prompt service at rock bottom prices.**

— RAM —

4116 200ns 8/$13.00
4116 150ns 8/$16.00
2114L 300ns 8/$16.95
2114L 200ns 8/$18.00
4164 200ns $13.00

— EPROM —

2716 (5v)450ns 8/$3.90 ea. $4.15 ea.
2716-1 (5v) 350ns $7.50 ea.
2732 (5v)450ns 8/$10.25 ea. $10.75
2532 (5v) 450ns 8/$12.00 $12.50 ea.

NEW Products Coming
Very Low Prices
Printers—Epson, Okidata, Paper Tiger & others
Terminals—Televideo's, Z-19's, Z-89's & others
Please call or write for other computer peripherals

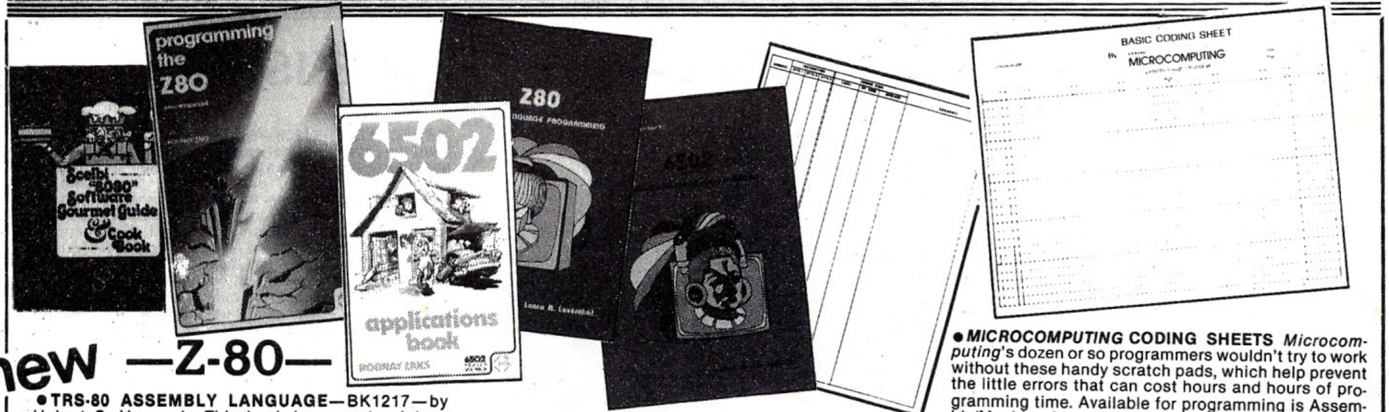
Call for quantity pricing
Call or write for Catalog
Please allow up to 3 wks. for Personal checks to clear
Master charge
VISA accepted.
Add $2.50 Shipping & Handling
C.O.D. $3.50, Wash. residents add 5.4% Sales Tax

CHIPS & DALE ✓170
P.O. BOX 31607, DEPT M
Seattle, Washington
Zip 98103
1-206-524-9126

CHIPS & DALE
Specializing in memory Chips

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685). 1. Title of publication, *Kilobaud Microcomputing*. 2. Date of filing, Oct. 1, 1981. 3. Frequency of issue, Monthly. A. No. of issues published annually, 12. B. Annual subscription price, $25.00. 4. Location of known office of publication (Street, City, County, State and ZIP Code) (Not printers), 80 Pine Street, Peterborough, Hillsboro County, N.H. 03458. 5. Location of the headquarters or general business offices of the publishers (Not printers), 80 Pine Street, Peterborough, Hillsboro County, N.H. 03458. 6. Names and complete addresses of publisher, editor and managing editor. Publisher (Name and Address), Wayne Green, Peterborough, N.H. 03458. Editor (Name and Address), Wayne Green, Peterborough, N.H. 03458. Managing Editor (Name and Address), Dennis Brisson, Swanzey Lake Road, Winchester, N.H. 03470. 7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) Name, 1001001, Inc., Peterborough, N.H. 03458. Wayne Green, Peterborough, N.H. 03458. 8. Known bondholders, mortgagees and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state) Name, none. 9. For completion by nonprofit organizations authorized to mail at special rates (Section 132.122, PSM) The purpose, function and nonprofit status of this organization and the exempt status for Federal income tax purposes (Check one) Not applicable. 10. Extent and nature of circulation. (X) Average No. copies each issue during preceding 12 months. (Y) Actual No. copies of single issue published nearest to filing date. A. Total No. of copies printed (Net Press Run) (X) 90,670 (Y) 88,000. B. Paid circulation 1. Sales through dealers and carriers, street vendors and counter sales, (X) 28,251 (Y) 35,260. 2. Mail subscriptions (X) 54,594 (Y) 49,129. C. Total paid circulation (Sum of 10B1 and 10B2) (X) 82,845 (Y) 84,389. D. Free distribution by mail, carrier or other means samples, complimentary, and other free copies (X) 540 (Y) 686. E. Total distribution (Sum of C and D) (X) 83,385 (Y) 85,075. F. Copies not distributed 1. Office use, left over, unaccounted, spoiled after printing (X) 5466 (Y) 1106. 2. Returns from news agents (X) 1819 (Y) 1819. G. Total (Sum of E, F1 and 2—should equal net press run shown in A) (X) 90,670 (Y) 88,000. 11. I certify that the statements made by me above are correct and complete. Signature and title of editor, publisher, business manager, or owner. Debra Boudrieau, Business Manager.

kb microcomputing book nook



new —Z-80—

● **TRS-80 ASSEMBLY LANGUAGE**—BK1217—by Hubert S. Howe, Jr. This book incorporates into a single volume all the pertinent facts and information you need to know to program and enjoy the TRS-80. Included are clear presentations of all introductory concepts, completely tested practical programs and subroutines, details of ROM and RAM and disk operating systems, plus comprehensive tables, charts and appendices. Suitable for the first time user or more experienced users. $9.95.*

● **INSIDE LEVEL II**—BK1183—For machine language programmers! This is a comprehensive reference guide to the Level II ROMs, allowing easy utilization of the sophisticated routines they contain. It concisely explains set-ups, calling sequences, variable passage and I/O routines. Part II presents an entirely new composite program structure which unloads under the SYSTEM command and executes in both BASIC and machine code with the speed and efficiency of a compiler. Special consideration is given to disk systems. $15.95.*

● **PROGRAMMING THE Z-80**—BK1122—by Rodnay Zaks. Here is assembly language programming for the Z-80 presented as a progressive, step-by-step course. This book is both an educational text *and* a self-contained reference book, useful to both the beginning and the experienced programmer who wish to learn about the Z-80. Exercises to test the reader are included. $15.95.*

● **Z-80 SOFTWARE GOURMET GUIDE AND COOKBOOK**—BK1045—by Nat Wadsworth. Scelbi's newest cookbook! This book contains a complete description of the powerful Z-80 instruction set and a wide variety of programming information. Use the author's ingredients including routines, subroutines and short programs, choose a time-tested recipe and start cooking! $16.99.*

● **Z-80 ASSEMBLY LANGUAGE PROGRAMMING**—BK1177—by Lance A. Leventhal. This book thoroughly covers the Z-80 instruction set, abounding in simple programming examples which illustrate software development concepts and actual assembly language usage. Features include Z-80 I/O devices and interfacing methods, assembler conventions, and comparisons with 8080A/8085 instruction sets and interrupt structure. $16.99.*

● **VOL. I COMPONENT TESTERS**—LB7359—. . . how to build transistor testers (8), diode testers (3), IC testers (3), voltmeters and VTVMs (9), ohmmeters (8 different kinds), inductance (3), capacity (9), Q measurement, crystal checking (6), temperature (2), aural meters for the blind (3) and all sorts of miscellaneous data on meters . . . using them, making them more versatile, making standards. Invaluable book. $4.95.*

● **VOL. II AUDIO FREQUENCY TESTERS**—LB7360— . . . jam packed with all kinds of audio frequency test equipment. If you're into SSB, RTTY, SSTV, etc., this book is a must for you . . . a good book for hi-fi addicts and experimenters, too! $4.95.*

● **VOL. III RADIO FREQUENCY TESTERS**—LB7361—Radio frequency waves, the common denominator of Amateur Radio. Such items as SWR, antenna impedance, line impedance, rf output and field strength; detailed instructions on testing these items includes sections on signal generators, crystal calibrators, grid dip oscillators, noise generators, dummy loads and much more. $4.95.*

● **VOL. IV IC TEST EQUIPMENT**—LB7362—Become a troubleshooting wizard! In this fourth volume of the 73 TEST EQUIPMENT LIBRARY are 42 home construction projects for building test equipment to work with your ham station and in servicing digital equipment. Plus a cumulative index for all four volumes for the 73 TEST EQUIPMENT LIBRARY. $4.95.*

PROGRAMMING

The Microprocessor Software Engineering Series by John Zarrella provides common sense descriptions of advanced computer system topics for engineers, programmers and development managers. Each volume is a self-contained review of a software engineering topic, explaining fundamental concepts in easy-to-understand language and describing sophisticated software tools and techniques. Detailed glossary of technical jargon is included in each volume. This series will help you find the solutions to your software problems.

● **OPERATING SYSTEMS: CONCEPTS AND PRINCIPLES**—BK1193—Presents an overview of the basic operating system types, their components and capabilities. $7.95.*

● **WORD PROCESSING AND TEXT EDITING**—BK1194—Provides a firm basis for understanding word processing terminology and for comparing systems. $7.95.*

● **SYSTEM ARCHITECTURE**—BK1195 —Presents a detailed overview of advanced computer system design including object architecture and capability-based addressing. $9.95.*

—6502—

*● **THE APPLE II USER'S GUIDE**—BK1220—by Lon Poole, Martin McNiff, and Steven Cook. This guide is the key to unlocking the full power of your Apple II or Apple II Plus. Topics include: "Applesoft and Integer BASIC Programming"—especially how to make the best use of Apple's sound, color and graphics capabilities. "Machine Level Programming," "Hardware Features"—which covers the disk drive and printer, and "Advanced Programming"—describing high resolution graphics techniques and other advanced applications. Well organized and easy to use. $15.00.*

● **PROGRAMMING THE 6502 (Third Edition)**—BK1005—Rodnay Zaks has designed a self-contained text to learn programming, using the 6502. It can be used by a person who has never programmed before, and should be of value to anyone using the 6502. The many exercises will allow you to test yourself and practice the concepts presented. $13.95.*

● **6502 APPLICATIONS BOOK**—BK1006—Rodnay Zaks presents practical-application techniques for the 6502 microprocessor, assuming an elementary knowledge of microprocessor programming. You will build and design your own domestic-use systems and peripherals. Self-test exercises included. $12.95.*

● **6502 ASSEMBLY LANGUAGE PROGRAMMING**—BK1176—by Lance A. Leventhal. This book provides comprehensive coverage of the 6502 microprocessor assembly language. Leventhal covers over 80 programming examples from simple memory load loops to complete design projects. Features include 6502 assembler conventions, input/output devices and interfacing methods, and programming the 6502 interrupt system. $16.99.*

● **6502 SOFTWARE GOURMET GUIDE AND COOKBOOK**—BK1055—by Robert Findley. This book introduces the BASIC language programmer into the realm of machine-language programming. The description of the 6502 structure and instruction set, various routines, subroutines and programs are the ingredients in this cookbook. "Recipes" are included to help you put together exactly the programs to suit your taste. $12.95.*

● ***MICROCOMPUTING* CODING SHEETS** *Microcomputing*'s dozen or so programmers wouldn't try to work without these handy scratch pads, which help prevent the little errors that can cost hours and hours of programming time. Available for programming is Assembly/Machine Language (PD1001), which has columns for address, instruction (3 bytes), source code (label, op code, operand) and comments; and for BASIC (PD1002) which is 72 columns wide. 50 sheets to a pad. $2.39.*

68000/6809/8080

*● **6809 MICROCOMPUTER PROGRAMMING AND INTERFACING**—BK1215—by Andrew C. Staugaard, Jr. Getting involved with Tandy's new Color Computer? If so, this new book from the Blacksburg Group will allow you to exploit the awesome power of the machine's 6809 microprocessor. Detailed information on processor architecture, addressing modes, register operation, data movement, arithmetic logic operations, I/O and interfacing is provided, as well as a review section at the end of each chapter. Four appendices are included covering the 6809 instruction set, specification sheets of the 6809 family of processors, other 6800 series equipment and the 6809/6821 Peripheral Interface Adapter. This book is a must for the serious Color Computer owner. $13.95.*

*● **68000 MICROPROCESSOR HANDBOOK**—BK1216—by Gerry Kane. Whether you're currently using the 68000, planning to use it, or simply curious about one of the newest and most powerful microprocessors, this handbook has all the answers. A clear presentation of signal conversions, timing diagram conventions, functional logic, three different instruction set tables, exception processing, and family support devices provides more information about the 68000 than the manufacturer's data sheets. A stand alone reference book which can also be used as a supplement to *An Introduction to Microcomputers: Vol. 2—Some Real Microprocessors.* $6.99.*

● **8080A/8085 ASSEMBLY LANGUAGE PROGRAMMING**—by Lance Leventhal—BK1004—Assembly language programming for the 8080A/8085 is explained with a description of the functions of assemblers and assembly instructions, and a discussion of basic software development concepts. Many fully debugged, practical programs are included as is a special section on structured programming. $15.99.*

● **8080 SOFTWARE GOURMET GUIDE AND COOKBOOK**—BK1102—If you have been spending too much time developing simple routines for your 8080, try this new book by Scelbi Computing and Robert Findley. Describes sorting, searching, and many other routines for the 8080 user. $12.95.*

—COOKBOOKS—

● **CMOS COOKBOOK**—BK1011—by Don Lancaster. Details the application of CMOS, the low power logic family suitable for most applications presently dominated by TTL. Required reading for every serious digital experimenter! $10.50.*

● **TVT COOKBOOK**—BK1064—by Don Lancaster. Describes the use of a standard television receiver as a microprocessor CRT terminal. Explains and describes character generation, cursor control and interface information in typical, easy-to-understand Lancaster style. $9.95.*

● **TTL COOKBOOK**—BK1063—by Don Lancaster. Explains what TTL is, how it works, and how to use it. Discusses practical applications, such as a digital counter and display system, events counter, electronic stopwatch, digital voltmeter and a digital tachometer. $9.50.*

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to Kilobaud *Microcomputing* Book Department ● Peterborough NH 03458. Be sure to include check or detailed credit card information.

No C.O.D. orders accepted. All orders add $1.50 for first book, $1.00 each additional book, $10.00 per book foreign airmail. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to customer Service at the following address.

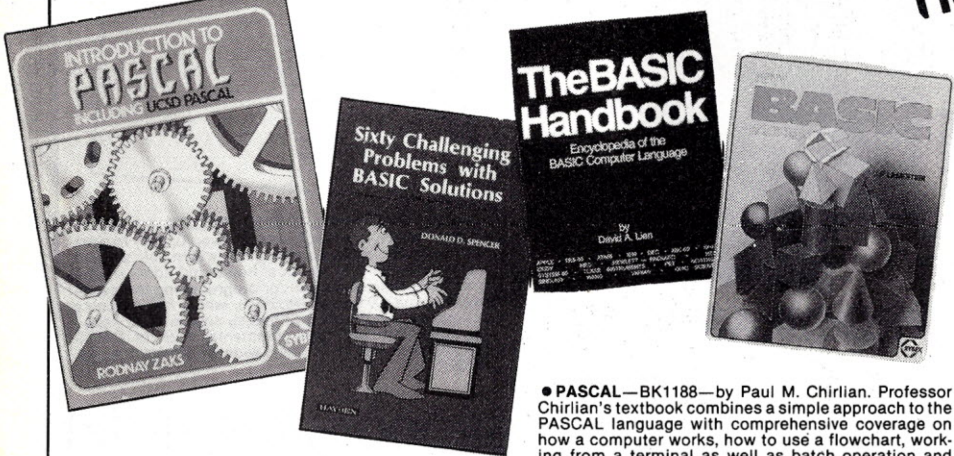
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

* new

FOR TOLL FREE ORDERING CALL 1-800-258-5473

kb microcomputing book nook

—BASIC & PASCAL—



new

● **INTRODUCTION TO TRS-80 LEVEL II BASIC AND COMPUTER PROGRAMMING**—BK1219—by Michael P. Zabinski. Written by an experienced educator, this is the book for those beginners who want to learn about computers without having to become an expert. It has practical programs, useful line-by-line comments, excellent flowcharts accompanied by line numbers and over 200 exercises which help the reader assess progress, reinforce comprehension, and provide valuable practical experience. $10.95.*

● **50 BASIC EXERCISES**—BK1192—by J. P. Lamoitier. This book is structured around the idea that the best way to learn a language is through actual practice. It contains 50 completely explained exercises: statement and analysis of the problem, flowcharts, programs and actual runs. Program subjects include mathematics, business, games, and operations research, and are presented in varying levels of difficulty. This format enables anyone to learn BASIC rapidly, checking their progress at each step. $12.95*

● **THE BASIC HANDBOOK—BK1174—SECOND EDITION**—by David Lien. This book is unique. It is a virtual ENCYCLOPEDIA of BASIC. While not favoring one computer over another, it explains over 250 BASIC words, how to use them and alternate strategies. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word or combination of words. That's where the HANDBOOK comes in. It helps you get the most from your computer, be it a "bottom-of-the-line" micro or an oversized monster. $19.95.*

● **LEARNING LEVEL II**—BK1175—by David Lien. Written especially for the TRS-80, this book concentrates on Level II BASIC, exploring every important BASIC language capability. Updates are included for those who have studied the Level I User's Manual. Sections include: how to use the Editor, dual cassette operation, printers and peripheral devices, and the conversion of Level I programs to Level II. $15.95.*

● **BASIC BASIC (2ND EDITION)**—BK1026—by James S. Coan. This is a textbook which incorporates the learning of computer programming using the BASIC language with the teaching of mathematics. Over 100 sample programs illustrate the techniques of the BASIC language and every section is followed by practical problems. This second edition covers character string handling and the use of data files. $10.50.*

● **ADVANCED BASIC**—BK1000—Applications, including strings and files, coordinate geometry, area, sequences and series, simulation, graphing and games. $10.75*.

● **SIXTY CHALLENGING PROBLEMS WITH BASIC SOLUTIONS (2nd Edition)**—BK1073—by Donald Spencer, provides the serious student of BASIC programming with interesting problems and solutions. No knowledge of math above algebra required. Includes a number of game programs, as well as programs for financial interest, conversions and numeric manipulations. $6.95.*

● **PASCAL**—BK1188—by Paul M. Chirlian. Professor Chirlian's textbook combines a simple approach to the PASCAL language with comprehensive coverage on how a computer works, how to use a flowchart, working from a terminal as well as batch operation and debugging. Special attention is paid to idiosyncrasies of the language and syntax flowcharts abound for the convenience of the experienced programmer. Well indexed. $12.95*

● **INTRODUCTION TO PASCAL**—BK1189—by Rodnay Zaks. A step-by-step introduction for anyone wanting to learn the language quickly and completely. Each concept is explained simply and in a logical order. All features of the language are presented in a clear, easy-to-understand format with exercises to test the reader at the end of each chapter. It describes both standard PASCAL and UCSD PASCAL, the most widely used dialect for small computers. No computer or programming experience is necessary. $14.95.*

● **PROGRAMMING IN PASCAL**—BK1140—by Peter Grogono. The computer programming language PASCAL was the first language to embody in a coherent way the concepts of structured programming, which has been defined by Edsger Dijkstra and C.A.R. Hoare. As such, it is a landmark in the development of programming languages. PASCAL was developed by Niklaus Wirth in Zurich; it is derived from the language ALGOL 60 but is more powerful and easier to use. PASCAL is now widely accepted as a useful language that can be efficiently implemented, and as an excellent teaching tool. It does not assume knowledge of any other programming language; it is therefore suitable for an introductory course. $12.95.*

—GAMES—

● **40 COMPUTER GAMES**—BK7381—Forty games in all in nine different categories. Games for large and small systems, and even a section on calculator games. Many versions of BASIC used and a wide variety of systems represented. A must for the serious computer gamesman. $7.95*

● **BASIC COMPUTER GAMES**—BK1074—Okay, so once you get your computer and are running in BASIC, then what? Then you need some programs in BASIC, that's what. This book has 101 games for you from very simple to real buggers. You get the games, a description of the games, the listing to put in your computer and a sample run to show you how they work. Fun. Any one game will be worth more than the price of the book for the fun you and your family will have with it. $7.50.*

● **MORE BASIC COMPUTER GAMES**—BK1182—edited by David H. Ahl. More fun in BASIC! 84 new games from the people who brought you *BASIC Computer Games.* Includes such favorites as Minotaur (battle the mythical beast) and Eliza (unload your troubles on the doctor at bargain rates). Complete with game description, listing and sample run. $7.50.*

● **WHAT TO DO AFTER YOU HIT RETURN**—BK1071—PCC's first book of computer games. . . 48 different computer games you can play in BASIC. . . programs, descriptions, many illustrations. Lunar Landing, Hammurabi, King, Civel 2, Qubic 5, Taxman, Star Trek, Crash, Market, etc. $10.95.*

new

—BUSINESS—

● **THEORY Z**—BK1226—How American Business Can Meet the Japanese Challenge—by William Ouchi. Why are the Japanese catching up and surpassing American industrial productivity? What allows Japanese industrialists to offer guaranteed lifetime employment to their workforce? This book will help you understand the Theory Z managerial philosophy and its implications for the American corporate future. Examples are given of the American industrial giants already operating under Z-style management, and the impact of this style on the quality of their executives and workers is explored. A must for the alert businessman, large or small. $12.95.*

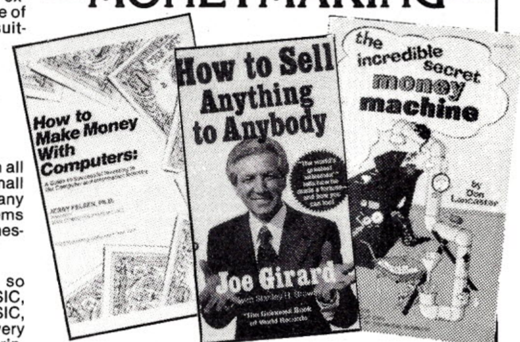
● **SO YOU ARE THINKING ABOUT A SMALL BUSINESS COMPUTER**—BK1222—by Richard G. Canning and Nancy C. Leeper. For a well-organized manual on the process of selecting the right computer system for your small business, this text can't be excelled. Designed to introduce the novice in data and word processing to the real benefits of computerization, the book is filled with money- and time-saving tips, photos of equipment, lists of suppliers, prices, explanations of computer terminology, and helpful references to additional sources of information. Everyone contemplating a first computer installation should have this book. $14.00.*

● **PAYROLL WITH COST ACCOUNTING—IN BASIC**—BK1001—by L. Poole & M. Borchers, includes program listings with remarks, descriptions, discussions of the principle behind each program, file layouts, and a complete user's manual with step-by-step instructions, flowcharts, and simple reports and CRT displays. Payroll and cost accounting features include separate payrolls for up to 10 companies, time-tested interactive data entry, easy correction of data entry errors, job costing (labor of distribution), check printing with full deduction and pay detail, and 16 different printed reports, including W-2 and 941 (in **CBASIC**). $20.00.*

● **SOME COMMON BASIC PROGRAMS**—BK1053—published by Adam Osborne & Associates, Inc. Perfect for non-technical computerists requiring ready-to-use programs. Business programs, plus miscellaneous programs. Invaluable for the user who is not an experienced programmer. All will operate in the stand-alone mode. $14.99 paperback.

● **PIMS: PERSONAL INFORMATION MANAGEMENT SYSTEM**—BK1009—Learn how to unleash the power of a personal computer for your own benefit in this ready-to-use data-base management program. $11.95.*

—MONEYMAKING—



● **HOW TO MAKE MONEY WITH COMPUTERS**—BK1003—In 10 information-packed chapters, Jerry Felsen describes more than 30 computer-related, money-making, high profit, low capital investment opportunities. $15.00.*

● **HOW TO SELL ANYTHING TO ANYBODY**—BK7306—According to *The Guinness Book of World Records*, the author, Joe Girard, is "the world's greatest salesman." This book reveals how he made a fortune—and how you can, too. $2.25.*

● **THE INCREDIBLE SECRET MONEY MACHINE**—BK1178—by Don Lancaster. A different kind of "cookbook" from Don Lancaster. Want to slash taxes? Get free vacations? Win at investments? Make money from something that you *like* to do? You'll find this book essential to give you the key insider details of what is really involved in starting up your own money machine. $5.95.*

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to Kilobaud *Microcomputing* Book Department ● Peterborough NH 03458. Be sure to include check or detailed credit card information.

No C.O.D. orders accepted. All orders add $1.50 for first book, $1.00 each additional book, $10.00 per book foreign airmail. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to customer Service at the following address.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

FOR TOLL FREE ORDERING CALL 1-800-258-5473

kb microcomputing book nook

—INTRODUCTORY—

new

● **UNDERSTANDING AND PROGRAMMING MICROCOMPUTERS**—BK7382—A valuable addition to your computing library. This two-part text includes the best articles that have appeared in 73 and Kilobaud Microcomputing magazines on the hardware and software aspects of microcomputing. Well-known authors and well-structured text helps the reader get involved. $10.95*

● **SOME OF THE BEST FROM KILOBAUD MICROCOMPUTING**—BK7311—A collection of the best articles that have appeared in Kilobaud MICROCOMPUTING. Included is material on the TRS-80 and PET systems, CP/M, the 8080/8085/Z-80 chips, the ASR-33 terminal. Data base management, word processing, text editors and file structures are covered too. Programming techniques and hard-core hardware construction projects for modems, high speed cassette interfaces and TVTs are also included in this large format, 200 plus page edition. $10.95.*

● **YOUR FIRST COMPUTER**—BK1191—by Rodnay Zaks. Whether you are using a computer, thinking about using one or considering purchasing one, this book is indispensable. It explains what a computer system is, what it can do, how it works and how to select various components and peripheral units. It is written in everyday language and contains invaluable information for the novice and the experienced programmer. (The first edition of this book was published under the title "An Introduction to Personal and Business Computing".) $8.95*

● **MICROPROCESSOR INTERFACING TECHNIQUES**—BK1037—by Austin Lesea & Rodnay Zaks—will teach you how to interconnect a complete system and interface it to all the usual peripherals. It covers hardware and software skills and techniques, including the use and design of model buses such as the IEEE 488 or S-100. $17.95.*

● **HOBBY COMPUTERS ARE HERE!**—BK7322—If you want to come up to speed on how computers work... hardware and software...this is an excellent book. It starts with fundamentals and explains the circuits, and the basics of programming, along with a couple of TVT construction projects, ASCII-Baudot, etc. This book has the highest recommendations as a teaching aid. $4.95.*

● **THE NEW HOBBY COMPUTERS**—BK7340—This book takes it from where "HOBBY COMPUTERS ARE HERE!" leaves off, with chapters on Large Scale Integration, how to choose a microprocessor chip, an introduction to programming, low cost I/O for a computer, computer arithmetic, checking memory boards...and much, much more! Don't miss this tremendous value! Only $4.95.*

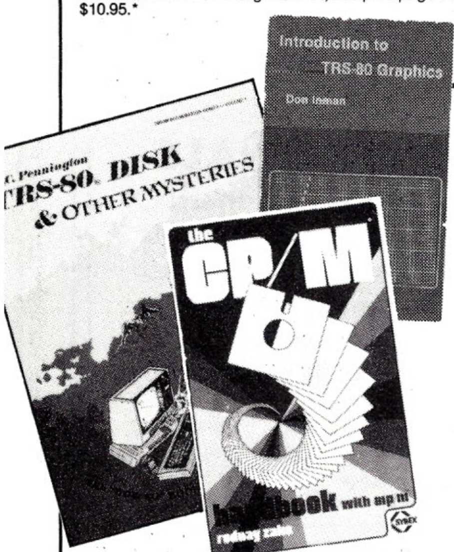
● **AN INTRODUCTION TO MICROCOMPUTERS, VOL. 0**—BK1130—The Beginner's Book—Written for readers who know nothing about computers—for those who have an interest in how to use computers—and for everyone else who must live with computers and should know a little about them. The first in a series of 4 volumes, this book will explain how computers work and what they can do. Computers have become an integral part of life and society. During any given day you are affected by computers, so start learning more about them with Volume 0. $7.95.*

● **VOL. I**—BK1030—**2nd Edition completely revised.** Dedicated to the basic concepts of microcomputers and hardware theory. The purpose of Volume I is to give you a thorough understanding of what microcomputers are. From basic concepts (which are covered in detail), Volume I builds the necessary components of a microcomputer system. This book highlights the difference between minicomputers and microcomputers. $12.99.*

● **VOL. II**—BK1040 (with binder)—Contains descriptions of individual microprocessors and support devices used only with the parent microprocessor. Volume II describes all available chips. $31.99*

● **VOL. III**—BK1133 (with binder)—Contains descriptions of all support devices that can be used with any microprocessor. $21.99*

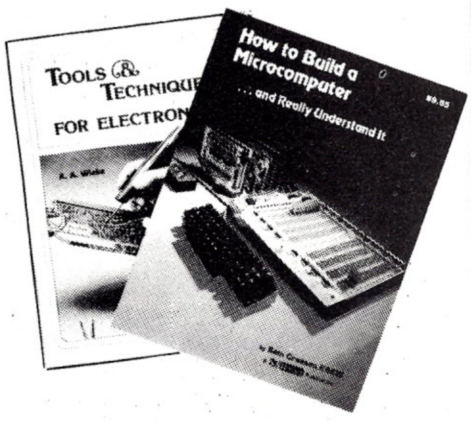
—SPECIAL INTERESTS—



new

● **THE CUSTOM TRS-80 AND OTHER MYSTERIES**—BK1218—by Dennis Kitsz. More than 300 pages of TRS-80 customizing information. With this book you'll be able to explore your computer like never before. Want to turn an 8 track into a mass storage unit? Individual reverse characters? Replace the BASIC ROMs? Make Music? High speed, reverse video, Level I and Level II? Fix it if it breaks down? All this and much, much more. Even if you have never used a soldering iron or read a circuit diagram, this book will teach you how! This is the definitive guide to customizing your 80! $29.95.*

● **BASIC FASTER AND BETTER AND OTHER MYSTERIES**—BK1221—by Lewis Rosenfelder. You don't have to learn assembly language to make your programs run fast. With the dozens of programming tricks and techniques in this book you can sort at high speed, swap screens in the twinkling of an eye, write INKEY routines that people think are in assembly language and add your own commands to BASIC. Find out how to write elegant code that makes your BASIC really hum, and explore the power of USR calls. $29.95.*



● **TRS-80 DISK AND OTHER MYSTERIES**—BK1181—by Harvard C. Pennington. This is the definitive work on the TRS-80 disk system. It is full of detailed "How to" information with examples, samples and in-depth explanations suitable for beginners and professionals alike. The recovery of one lost file is worth the price alone. $22.50.*

● **MICROSOFT BASIC DECODED AND OTHER MYSTERIES**—BK1186—by James Farvour. From the company that brought you *TRS-80 DISK AND OTHER MYSTERIES*! Contains more than 6500 lines of comments for the disassembled Level II ROMs, six additional chapters describing every BASIC subroutine, with assembly language routines showing how to use them. Flowcharts for all major routines give the reader a real insight into how the interpreter works. $29.50.

● **THE CP/M HANDBOOK (with MP/M)**—BK1187—by Rodnay Zaks. A complete guide and reference handbook for CP/M—the industry standard in operating systems. Step-by-step instruction for everything from turning on the system and inserting the diskette to correct user discipline and remedial action for problem situations. This also includes a complete discussion of all versions of CP/M up to and including 2.2, MP/M and CDOS. $14.95*.

● **INTRODUCTION TO TRS-80 GRAPHICS**—BK1180—by Don Inman. Dissatisfied with your Level I or Level II manual's coverage of graphics capabilities? This well-structured book (suitable for classroom use) is ideal for those who want to use all the graphics capabilities built into the TRS-80. A tutorial method is used with many demonstrations. It is based on the Level I, but all material is suitable for Level II use. $8.95.*

● **TOOLS & TECHNIQUES FOR ELECTRONICS**—BK7348—by A. A. Wicks is an easy-to-understand book written for the beginning kit builder as well as the experienced hobbyist. It has numerous pictures and descriptions of the safe and correct ways to use basic and specialized tools for electronic projects as well as specialized metal working tools and the chemical aids which are used in repair shops. $4.95.*

● **HOW TO BUILD A MICROCOMPUTER—AND REALLY UNDERSTAND IT**—BK7325—by Sam Creason. The electronics hobbyist who wants to build his own microcomputer system now has a practical "How-To" guidebook. This book is a combination technical manual and programming guide that takes the hobbyist step-by-step through the design, construction, testing and debugging of a complete microcomputer system. Must reading for anyone desiring a true understanding of small computer systems. $9.95.*

*Use the order card in this magazine or itemize your order on a separate piece of paper and mail to Kilobaud *Microcomputing* Book Department ● Peterborough NH 03458. Be sure to include check or detailed credit card information.

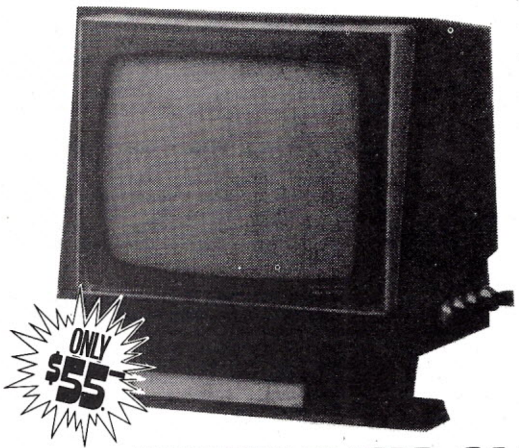
No C.O.D. orders accepted. All orders add $1.50 for first book, $1.00 each additional book, $10.00 per book foreign airmail. Please allow 4-6 weeks for delivery. Questions regarding your order? Please write to customer Service at the following address.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

FOR TOLL FREE ORDERING CALL 1-800-258-5473

SELECTRONICS

Does it again. . . . high quality Sylvania monitors at the lowest prices ever. These monitors have been thoroughly checked and guaranteed.



MONITORS

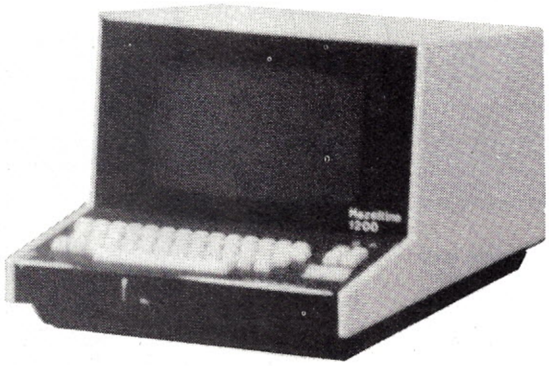
12" black & white monitor. Wide band, will display 80 x 24 char. 10K or 75Ω input impedance, composite video input. Transformer power supply.
Shpt. Wt. 30#
Price: $55 ea.
Used with all computers such as: TRS-80, Apple, and many others.
Complete manual $5.00.

PERKIN-ELMER CAROUSEL 350 TERMINAL

Only Selectronics could bring you this unbelievable opportunity to own the finest high-quality KSR terminal ever made. These machines originally listed for more than $4200. Check these outstanding features:

* Letter quality printing with upper and lowercase
* Microprocessor controlled
* 76-key alphanumeric keyboard with 10-key numeric pad
* EIA RS232C asynchronous serial interface
* 40 cps print rate
* 132 character buffer
* Full or half duplex
* Parity—odd, even, none
* Replacable print cups and elements

Excellent Condition—$750.00 F.O.B. our warehouse.
Shpt. Wt. 90#



HAZELTINE 1200 TERMINALS

SOLD OUT

24 x 80 character display; 5x7 dot matrix, Raster Scan, full ASCII keyboard; dc to 9600 baud, RS-232 interface; odd, even or no parity enable; full/half duplex, MOS-shift register memory with constant refresh.
ONLY $200.00

Also HAZELTINE 1000's
12 x 80 character baud rate 300
Shpt. Wt. 45#
FOB our warehouse
ONLY $150.00

ACOUSTIC COUPLE MODEM

Sold out

**Originate only 300 baud, full or half duplex, Shpt. Wt. 10#
ONLY $49.00**

COMPUTER CARBONLESS PAPER

**14-7/8 x 11, one-part. 3000 sheets per carton.
$24.00 per carton, 5 for $100.00
FOB Phila., Pa.
Shipping Weight 35 lbs.**

DIGITAL DISPLAY BOARDS

6 digit numeric display boards with 6 FND 507. Common anode displays and 10 red LED's. With drivers & logic for multiplexed operation. Price: $5.00 ea. or 6/$25.00.

All items have been thoroughly checked and are in excellent working condition.

✓205

* Test Equipment
* Power Supply Components
* Power Supplies
* Communication Equipment
* Pulse Equipment

SELECTRONICS

**Phone:
215-468-4645
215-468-7891**

1206 S. Napa Street • Philadelphia PA 19146

Penna. resident please add 6% sales tax. **ALL PRICES ARE F.O.B.** our warehouse. Phila. PA. All merchandise accurate as to description to the best of our knowledge. Your purchase money refunded if not satisfied. Min. order $10.00.

FULL LINE ALL PARTS & COMPUTER PRODUCTS

Quest ELECTRONICS ✓44

P.O. Box 4430S
Santa Clara, CA 95054
Will calls: 2322 Walsh Ave.
(408) 988-1640

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

INTEGRATED CIRCUITS

Phone orders only (800) 538-8196

7400TTL	
7400N	.19
7402N	.19
7404N	.22
7409N	.19
7410N	.19
7414N	.55
7420N	.19
7422N	.29
7430N	.19
7442N	.49
7445N	.69
7447N	.69
7448N	.69
7450N	.19
7474N	.35
7475N	.49
7485N	.65
7489N	1.70
7490N	.35
7492N	.43
7493N	.43
7495N	.55
74100N	1.00
74107N	.30
74121N	.29
74123N	.55
74125N	.45
74145N	.60
74150N	1.20
74151N	.65
74154N	1.25
74157N	.55
74161N	.70
74162N	.85
74163N	.85
74174N	.89
74175N	.85
74190N	1.15
74192N	.79
74193N	.79
74221N	1.25
74298N	.85
74365N	.65
74366N	.65
74367N	.65
74LS00 TTL	
74LS00N	.25
74LS02N	.25
74LS04N	.25
74LS05N	.25
74LS08N	.35
74LS10N	.25
74LS13N	.45
74LS14N	.99
74LS20N	.25
74LS22N	.25
74LS28N	.35
74LS30N	.25
74LS33N	.55
74LS38N	.35
74LS74N	.45
74LS75N	.50
74LS90N	.60
74LS93N	.65
74LS95N	.85
74LS107N	.40
74LS112N	.45
74LS113N	.45
74LS132N	.75
74LS136N	.49
74LS151N	.75
74LS155N	.79
74LS157N	.75
74LS162N	.95
74LS163N	.95
74LS174N	.95
74LS190N	1.00
74LS221N	1.19
74LS258N	.69
74LS367N	.69
LINEAR	
CA3045	.90
CA3046	1.10
CA3081	1.80
CA3082	1.90
CA3089	3.40
LM301AN/AH	.34

LM305H	.87
LM307N	.35
LM308N	.98
LM309K	1.25
LM311H/N	.64
LM317T	1.65
LM317K	3.75
LM318	1.49
LM320K-5	1.35
LM320K-12	1.35
LM320K-15	1.35
LM320T-5	.95
LM320T-8	.95
LM320T-12	.95
LM320T-15	.95
LM323K-5	4.95
LM324N	.99
LM339N	.99
LM340K-5	1.35
LM340K-8	1.35
LM340K-12	1.35
LM340K-15	1.35
LM340K-24	1.35
LM340T-5	.85
LM340T-8	.85
LM340T-12	.85
LM340T-15	.85
LM340T-18	.85
LM340T-24	.85
LM350	5.50
LM377	2.29
LM379	5.00
LM380N	1.00
LM381	1.60
LM382	1.60
LM709H	.59
LM723H/N	.49
LM733N	.85
LM741CH	.35
LM741N	.35
LM747H/N	.75
LM748N	.50
LM1303N	1.75
LM1304	1.10
LM1305	1.27
LM1307	1.10
LM1310	2.75
LM1458	.55
LM1812	8.25
LM1889	2.49
LM2111	1.75
LM2902	2.25
LM3900N	.59
LM3905	1.25
LM3909N	.95
MC1458V	.55
NE550N	1.30
NE555V	.39
NE556A	.85
NE565A	1.00
NE566V	1.50
NE567V	1.00
NE570B	4.75
78L05	.60
78L08	.60
78M05	.85
75108	1.49
75491CN	.50
75492CN	.55
75494CN	.89
A to D CONVERTE	
8038B	4.50
8700CJ	13.95
8701CN	22.00
8750CJ	13.95
LD130	9.95
9400CJV/F	7.40
ICL7103	9.50
ICL7107	14.25
CMOS	
CD4000	.25
CD4001	.35
CD4002	.35
CD4006	.95
CD4007	.25
CD4008	.95
CD4009	.45
CD4010	.45

CD4011	.35
CD4012	.25
CD4013	.45
CD4014	.95
CD4015	.95
CD4016	.45
CD4017	1.05
CD4018	.94
CD4019	.45
CD4020	.95
CD4021	.95
CD4022	1.10
CD4023	.28
CD4024	.75
CD4025	.23
CD4026	1.65
CD4027	.65
CD4028	.80
CD4029	.95
CD4030	.45
CD4035	.85
CD4040	.95
CD4042	.75
CD4043	.85
CD4044	.85
CD4046	.95
CD4049	.45
CD4050	.55
CD4051	.95
CD4060	1.42
CD4066	.71
CD4068	.39
CD4069	.35
CD4070	.35
CD4071	.30
CD4072	.30
CD4073	.35
CD4075	.30
CD4076	.95
CD4078	.30
CD4081	.30
CD4082	.30
CD4116	.47
CD4490	5.50
CD4507	.99
CD4508	1.95
CD4510	.95
CD4511	.94
CD4515	2.25
CD4516	1.10
CD4518	1.25
CD4520	1.02
CD4527	1.51
CD4528	1.25
CD4553	3.50
CD4566	2.45
CD4583	2.35
CD4585	.95
CD40192	3.00
74C00	.35
74C04	.35
74C10	.35
74C14	.75
74C20	.35
74C30	.35
74C48	1.95
74C74	.85
74C76	.80
74C90	1.25
74C93	1.25
74C154	3.25
74C160	1.69
74C175	1.19
74C192	1.65
74C221	1.90
74C905	6.00
74C906	.75
74C914	1.95
74C922	5.00
74C923	5.50
74C925	6.75
74C926	6.95
74C927	6.95
INTERFACE	
8095	.65
8096	.65
8097	.65
8098	.65
8T09	1.25

8T10	1.75
8T13	1.40
8T20	4.95
8T23	1.75
8T24	1.75
8T25	3.20
8T26	1.69
8T28	1.95
8T97	.99
8T98	1.65
MOS/MEMORY	
RAM	
2101-1	1.95
2102-1	.85
2102AL-4	1.45
2102AN-2L	1.65
2104A-4	4.95
2107B-4	3.75
2111-1	2.99
2112-2	2.99
2114	2.24
2114L 300ns	4.25
2114L 450ns	2.37
4116 200ns	2.95
8/4116 200ns	16.95
MM5262	.40
MM5280	3.00
MM5320	9.95
MM5330	5.94
PD411D-3	4.00
PD411D-4	5.00
P5101L	8.95
4200A	11.50
82S25	2.90
91L02A	1.50
MM57100	4.50
GIAY38500-1	9.95
9368	3.50
410D	10.00
416	16.00
CLOCKS	
MM5311	4.95
MM5312	3.90
MM5314	3.90
MM5369	1.95
MM5841	14.45
MM5865	7.95
CT7010	8.95
CT7015	8.95
MM5375AA/N	3.90
MM5375AG/N	4.90
7205	16.50
7207	7.50
7208	15.95
7209	4.95
DS0026CN	3.75
DS0056CN	3.75
MM53104	2.50
MICROPROCESSOR	
6502	6.95
6504	6.95
6522	9.95
6530	9.50
6800	6.95
6802	11.95
6820	4.95
6850	4.75
8080A	3.95
8085	8.50
Z80	8.95
Z80A	9.95
8212	2.25
8214	3.90
8216	2.25
8224	2.50
8228	4.95
8251	5.50
8253	8.95
8255	5.25
8257	9.00
8259	9.95
1802CE plas.	13.95
1802E plas.	17.95
1861P	9.50

UART/FIFO	
AY5-1013	5.50
AY5-1014	7.50
3341	6.95
PROM	
1702A	4.50
2532	19.75
2708	3.95
2716TI	8.50
2716 5 Volt	5.95
8/2716 5 Volt	46.95
2732	16.50
2758	7.49
8741A	39.95
8748	55.00
8748-8	55.00
8755A	49.95
N82S23	2.95
N82S123	3.95
N82S126	5.75
N82S129	4.75
N82S131	4.95
N82S136	8.75
N82S137	8.75
DM8577	2.90
8223	3.50
CONNECTORS	
30 pin edge	2.50
44 pin edge	2.75
86 pin edge	4.00
100 pin edge	3.95
100 pin edge w/w	4.95

IC SOCKETS
Solder Tin Low Profile

PIN	1UP	PIN	1UP
8	.13	22	.30
14	.14	24	.30
16	.16	28	.40
18	.20	36	.58
20	.29	40	.49

WIRE WRAP LEVEL 3

PIN		PIN	
14	.55	24	.93
16	.57	28	1.00
18	.67	40	1.59
2 level 14 pin w/w	.20		

CRYSTALS	
1 MHz	4.50
2 MHz	4.50
4 MHz	4.25
5 MHz	4.25
10 MHz	4.25
18 MHz	3.90
20 MHz	3.90
32 MHz	3.90
32768 Hz	4.00
1.8432 MHz	4.50
3.5795 MHz	1.20
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
3.2768 MHz	4.50
5.0688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
6.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50
KEYBOARD ENCODERS	
AY5-2376	11.95
AY5-3600	17.95
AY5-9100	10.50
AY5-9200	14.95
74C922	5.49
74C923	5.50
HD0165-5	7.95
D Connectors RS232	
DB25P	2.95
DB25S	3.50
Cover	1.67

DE9S	1.95
DA15P	2.10
DA15S	3.10
Complete Set	9.50
Stopwatch Kit	**26.95**
Auto Clock Kit	**17.95**
Digital Clock Kit	**19.75**
RESISTORS ¼ watt 5%	
10 per type	.03
25 per type	.025
100 per type	.015
1000 per type	.012
350 piece pack, 5 per type	6.75
½ watt 5% per type	.05
DIP SWITCHES	
4-position	.85
5-position	.90
6-position	.90
7-position	.95
8-position	.95
KEYBOARDS	
56 key ASCII keyboard kit	$74.95
Fully assembled	84.50
Enclosure Plastic	94.95
Metal Enclosure	39.95
LEDS	
Red T018	.15
Green, Yellow T018	.20
Jumbo Red	.25
Green, Orange, Yellow Jumbo	.25
Clipilte LED Mounting Clips	8/$1.25
(spec: red, amber, green, yellow, clear)	

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip.

OK WIRE WRAP TOOLS in stock
Complete line of AP Products in stock.

SPECIAL PRODUCTS	
2.5 MHz Freq. Counter Kit	37.50
30 MHz Freq. Counter Kit	47.75
TRANSFORMERS	
6V 300 ma	3.25
12 Volt 300 ma transformer	1.25
12.6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.75
24V CT 100 ma	3.95
10V 1.2 amp wall plug	4.85
12V 6 amp	12.95
12V 500 ma wall plug	4.75
12V 1 amp wall plug	6.50
10/15 VAC 8/16 VA wall plug	9.75

DISPLAY LEDS			
MAN1	CA	.270	2.90
MAN3	CC	.125	.25
MAN72/74	CA/CA	.300	.75
DL704	CC	.300	1.25
DL707/DL707R	CA	.300	1.00
DL727/728	CA/CC	.500	1.90
DL747/750	CA/CC	.600	1.49
FND359	CC	.357	.70
FND500/507	CC/CA	.500	.99
FND503/510	CC/CA	.500	.90
FND800/807	CC/CA	.800	2.20
3 digit bubble			.60
10 digit display			1.25
7520 Clairex photocells			.39
TIL311 Hex			9.50
MAN3640	CC	.30	.99
MAN4610	CA	.40	.99
MAN4640	CC	.40	1.20
MAN4710	CA	.40	.95
MAN4740	CC	.40	1.20
MAN6640	CC	.56	.99
MAN6710	CA	.60	.99
MAN6740	CC	.60	.99

TELEVIDEO TERMINAL
Model 950 $1010.00

4116 200ns Dynamic RAM 8/$16.95

RCA Cosmac 1802 Super Elf Computer $106.95

The Super Elf is a small single board computer that does many **big** things. It's an excellent computer for training and for learning programming with its machine language and yet it's easily **expanded with additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Moews Video Graphics **$3.50**, Games and Music **$3.00**, Chip 8 Interpreter **$5.50**, Starship 4K cassette **$14.95.**

Free 14 page brochure of complete Super Elf system.

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed**. EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports with full handshake.** They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at $15.25 for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply below).

ELECTRONIC SYSTEM KITS

Apple Peripheral Kits

SERIAL I/O INTERFACE 0 to 30,000 baud, D.T.R., Input & output from monitor or basic, or use Apple as intelligent terminal. Bd only (P/N 2) **$14.95,** Kit (P/N 2A) **$51.25,** Assembled (P/N 2C) **$62.95.**

PROTOTYPING BOARD (P/N 7907) **$21.95.**

PARALLEL TRIAC OUTPUT BOARD 8 triacs, each can switch 110V, 6A loads, Bd only (P/N 210) **$19.20,** Kit (P/N 210A) **$119.55.**

OPTO-ISOLATED INPUT BOARD 8 inputs, can be driven from TTL logic, Bd only (P/N 120) **$15.65,** Kit (P/N 120A) **$69.95.**

Interface Kits

SERIAL/PARALLEL INTERFACE Bidirectional, Baud rates from 110 to 19.2K, sw selectable polarity of input and output strobe, 5 to 8 data bits, 1 or 2 stop bits, parity odd or even or none, all characters contain a start bit, +5 & −12V required. Bd only (P/N 101) **$11.95,** Kit (P/N 101A) **$42.89.**

RS-232/TTL INTERFACE Bidirectional, requires ±12V, Kit (P/N 232A) **$9.95.**

RS-232/20mA INTERFACE Bidirectional, 2 passive opto-isolated circuits, Kit (P/N 7901A) **$14.95.**

PROM Eraser

Will erase 25 PROMs in 15 minutes. Ultraviolet, assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$9.95**

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00.** Tiny Basic **$30.00.**

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included. Bd. only $17.00. Article in June *Radio Electronics.*

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

Video Modulator Kit $9.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display ROM monitor;, fully expandable. **$419.00.** 4K version **$449.00.** 4K Assembler **$35.00,** 8K Basic Interpreter **$65.00.**

Special small power supply 5V 2A 24V .5A assem. in frame **$59.00.** Molded plastic enclosure to fit both AIM 65 and power supply **$52.50.** AIM 65 1K in cabinet with power supply, switch, fuse, cord assem. **$559.00.** 4K **$579.00. A65/40-5000 AIM 65/40 w/16K RAM and monitor $1295.00.** RAM Board Kit (16K, **$195**) (32K, **$215**). VD640 Video Interface Kit **$119.00.** A&T **$149.00.** Complete AIM 65 in thin briefcase with power supply **$518.00.** Special Package Price: 4K AIM, 8K Basic, power supply, cabinet **$629.00**

AIM 65/KIM/SYM/Super Elf 44 pin expansion board; board with 3 connectors **$22.95.**

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range $\pm .17E^{38}$), 32 bit integer ±2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs; and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.**

Also, an exclusive user expandable command library.

Serial and Parallel I/O routines included.

Super Basic on Cassette $55.00.

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80, etc. **Dealers: Send for excellent pricing/margin program.**

Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface **$369.00.**

1802 16K Dynamic RAM Kit $149.00

Expandable to 64K. Hidden refresh w/clocks up to 4 MHz w/no wait states. Addl. 16K RAM **$25.00.**

S-100 4-slot expansion $ 9.95
Super Monitor VI.I Source Listing $15.00

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

TERMS: $5.00 min. order U.S. Funds. Calif. residents add 6% tax.
$10.00 min. VISA and MasterCard accepted. $1.00 insurance optional.
Shipping: Add 5%; orders under $25.00—10%.

FREE: Send for your copy of our NEW 1981 QUEST CATALOG. Include 88¢ stamp.

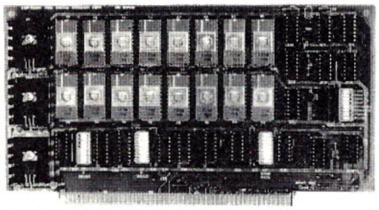
✓See List of Advertisers on page 210

DIGITAL RESEARCH COMPUTERS

(214) 271-3538

32K S-100 EPROM CARD

NEW!



$79.95
KIT

USES 2716's

Blank PC Board - $34

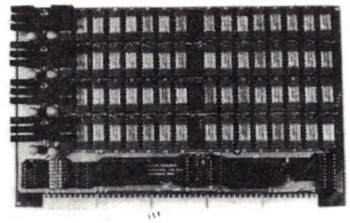
ASSEMBLED & TESTED ADD $30

SPECIAL: 2716 EPROM's (450 NS) Are $9.95 Ea. With Above Kit.

KIT FEATURES:
1. Uses +5V only 2716 (2Kx8) EPROM's.
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible.
4. Addressable as two independent 16K blocks.
5. Cromemco extended or Northstar bank select.
6. On board wait state circuitry if needed.
7. Any or all EPROM locations can be disabled.
8. Double sided PC board, solder-masked, silk-screened.
9. Gold plated contact fingers.
10. Unselected EPROM's automatically powered down for low power.
11. Fully buffered and bypassed.
12. Easy and quick to assemble.

32K SS-50 RAM

$299.00 KIT



For 2MHZ Add $10

Blank PC Board $50

For SWTPC 6800 - 6809 Buss

Support IC's and Caps $19.95

Complete Socket Set $21.00

Fully Assembled, Tested, Burned In Add $30

At Last! An affordable 32K Static RAM with full 6809 Capability.

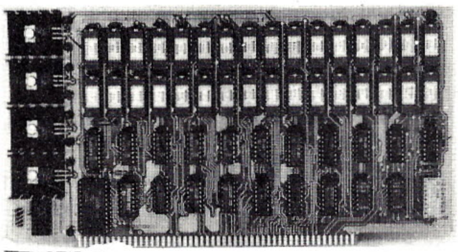
FEATURES:
1. **Uses proven low power 2114 Static RAMS.**
2. **Supports SS50C - EXTENDED ADDRESSING.**
3. **All parts and sockets included.**
4. **Dip Switch address select as a 32K block.**
5. **Extended addressing can be disabled.**
6. **Works with all existing 6800 SS50 systems.**
7. **Fully bypassed. PC Board is double sided, plated thru, with silk screen.**

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

$169.95 KIT

FOR 4MHZ ADD $10



KIT FEATURES:
1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry. (Cromemco Standard!). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 1.5 amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA-**$33**

LOW PROFILE SOCKET SET-**$12**

SUPPORT IC'S & CAPS-**$19.95**

ASSEMBLED & TESTED-**ADD $35**

OUR #1 SELLING RAM BOARD!

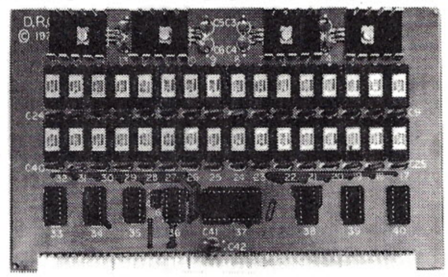
16K STATIC RAM SS-50 BUSS

PRICE CUT!

$159 KIT

FULLY STATIC!

FOR 2MHZ ADD $10



FOR SWTPC 6800 BUSS!

ASSEMBLED AND TESTED - $35

KIT FEATURES:
1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Fully Bypassed
4. Double sided PC Board. Solder mask and silk screened layout
5. All Parts and Sockets included
6. Low Power: Under 1.5 Amps Typical

BLANK PC BOARD—**$35** COMPLETE SOCKET SET—**$12**

SUPPORT IC'S AND CAPS—**$19.95**

NEW! STEREO! S-100 SOUND COMPUTER BOARD NEW!

At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

COMPLETE KIT! $84.95 (WITH DATA MANUAL)

BLANK PC BOARD W/DATA $31

KIT FEATURES:
- ⋆ TWO GI SOUND COMPUTER IC'S.
- ⋆ FOUR PARALLEL I/O PORTS ON BOARD.
- ⋆ USES ON BOARD AUDIO AMPS OR YOUR STEREO.
- ⋆ ON BOARD PROTO TYPING AREA.
- ⋆ ALL SOCKETS, PARTS AND HARDWARE ARE INCLUDED.
- ⋆ PC BOARD IS SOLDERMASKED, SILK SCREENED, WITH GOLD CONTACTS.
- ⋆ EASY, QUICK, AND FUN TO BUILD. WITH FULL INSTRUCTIONS.
- ⋆ USES PROGRAMMED I/O FOR MAXIMUM SYSTEM FLEXIBILITY.

Both Basic and Assembly Language Programming examples are included.

SOFTWARE:

SCL™ is now available! Our Sound Command Language makes writing Sound Effects programs a SNAP! SCL™ also includes routines for Register-Examine-Modify, Memory-Examine-Modify, and Play-Memory. SCL™ is available on CP/M* compatible diskette or 2708 or 2716. Diskette - **$24.95** 2708 - **$19.95** 2716 - **$29.95.** Diskette includes the source. EPROM'S are ORG at E000H. **(Diskette is 8 Inch Soft Sectored)**

SPECIAL PURCHASE!

UART SALE!

TR1602B — SAME AS TMS6011, AY5-1013, ETC. 40 PIN DIP

TR1602B

$2.95 EACH **4 For $10.00**

CRT CONTROLLER CHIP

SMC #CRT 5037. PROGRAMMABLE FOR 80 x 24, ETC. VERY RARE SURPLUS FIND. WITH PIN OUT. $12.95 EACH.

4K STATIC RAM

National Semi. MM5257. Arranged 4K x 1. +5V, 18 PIN DIP. A Lower Power, Plug in Replacement for TMS 4044. 450 NS. Several Boards on the Market Will Accept These Rams. SUPER SURPLUS PURCHASE! **PRIME NEW UNITS!**

8 FOR $16 32 FOR $59.95

NEW! G.I. COMPUTER SOUND CHIP

AY3-8910. As featured in July, 1979 BYTE! A fantastically powerful Sound & Music Generator. Perfect for use with any 8 Bit Microprocessor. Contains: 3 Tone Channels, Noise Generator, 3 Channels of Amplitude Control, 16 bit Envelope Period Control, 2-8 Bit Parallel I/O, 3 D to A Converters, plus much more! All in one 40 Pin DIP. Super easy interface to the S-100 or other busses. **$11.95** **PRICE CUT!**

SPECIAL OFFER: ~~$14.95~~ each Add $3 for 60 page Data Manual.

Digital Research Computers

(OF TEXAS)

P.O. BOX 401565 • GARLAND, TEXAS 75040 • (214) 271-3538

TERMS: Add $2.00 postage. We pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa and MasterCharge. Tex. Res. add 5% Tax. Foreign orders (except Canada) add 20% P & H. Orders over $50, add 85¢ for insurance.

ALL SALES ARE MADE SUBJECT TO THE TERMS OF OUR 90 DAY LIMITED WARRANTY. A COPY OF THIS WARRANTY IS AVAILABLE FREE, ON REQUEST.

***TRADEMARK OF DIGITAL RESEARCH.** **WE ARE NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE SUPPLIERS OF CPM SOFTWARE.**

"THE BIG BOARD"

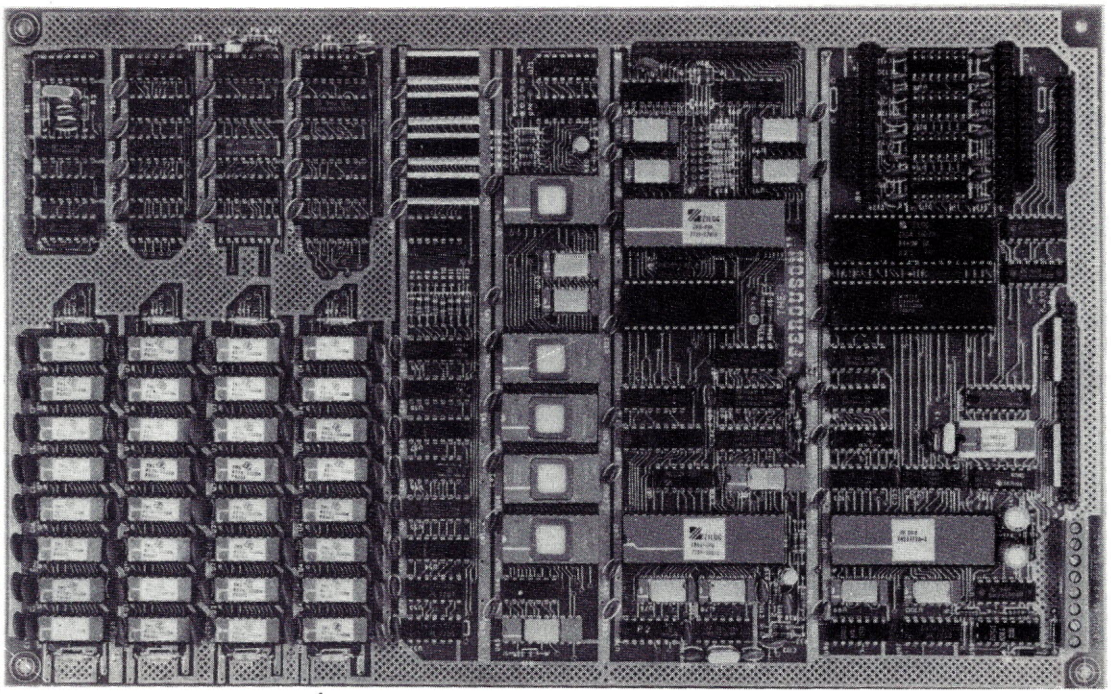
OEM - INDUSTRIAL - BUSINESS - SCIENTIFIC

NEW! NEW!

SINGLE BOARD COMPUTER KIT!

Z-80 CPU! 64K RAM!

PARTIALLY ASSEMBLED KITS
For All Sockets Installed
And Soldered Add $50.



U.K. AND EUROPE: CONTACT VINCELORD LTD. 47 GOLDHURST TERRACE LONDON NW6

THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, an enclosure, C.R.T., and you have a total Business System for about 1/3 the cost you might expect to pay.

$649.00 ** (64K KIT BASIC I/O)

SIZE: 8½ x 13¾ IN.
SAME AS AN 8 IN. DRIVE.
REQUIRES: +5V @ 3 AMPS
+ - 12V @ .5 AMPS.

FULLY SOCKETED!

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: $85.

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true. 5 x 7 Matrix - Upper & Lower Case

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

TWO PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $29.95

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $14.95

SYSTEM COMPARISON

64K RAM KIT	$370.00
80 x 24 Video Kit	365.00
Floppy Disk Controller Kit	235.00
Z-80 CPU Kit	185.95
SER & PAR. I/O	129.95
S-100 Mother Board	45.00
SUB TOTAL	$1330.90

Talk about bangs per buck! The prices shown for S100 kits were taken from the July 1980 BYTE. This will give some basis for comparison between the Big Board and a similar system implementation on the S100 Buss.

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. modified by MICRONIX SYSTEMS to run on Big Board is available for $150.00.

PC BOARD

Blank PC Board with Rom Set and Full Documentation. $199.00

PFM 3.0 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided.

Z-80 is a Trademark of Zilog.

Digital Research Computers
(OF TEXAS)

P.O. BOX 401565 • GARLAND, TEXAS 75040 • (214) 271-3538

TERMS: Shipments will be made approximately 3 to 6 weeks after we receive your order. VISA, MC, cash accepted. We will accept COD's (for the Big Board only) with a $75 deposit. Balance UPS COD. Add $3.00 shipping.

USA AND CANADA ONLY

*TRADEMARK OF DIGITAL RESEARCH. NOT ASSOCIATED WITH DIGITAL RESEARCH OF CALIFORNIA, THE ORIGINATORS OF CPM SOFTWARE
**1 TO 4 PIECE DOMESTIC USA PRICE.

✓See List of Advertisers on page 210

WAMECO

THE COMPLETE PC BOARD HOUSE
EVERYTHING FOR THE S-100 BUSS

* **CPU-2** Z80 PROCESSOR BOARD ON BOARD ROM AND HARDWARE POWER ON JUMP.
  PCBD .... $35.95 KIT $135.95

* **MEM-3** 24 ADDRESS LINES EXPANDABLE IN 1K INCR. ADDRESSABLE IN 8K BLOCKS. BIDIRECTIONAL BUSSING.

PCBD	$ 42.95	KIT LESS RAM	$119.95
KIT WITH 2114L-4	$475.95	KIT WITH 2114L-2	$549.95
A&T WITH 2114L-4	$505.95	A&T WITH 2114L-2	$579.95

* **FPB-1A** FRONT PANEL BOARD FOR 8080A AND Z80 SYSTEMS IMSAI COMPATIBLE.
  PCBD .... $56.95 KIT $175.00

* **EPM-2** 16/32K ROM USES 2716 OR 2708. ADDRESSABLE IN 4K BOUNDARIES.
  PCBD .... $33.95 KIT (LESS ROMS) $74.95

* **CPU-1** 8080A PROCESSOR BOARD WITH VECTOR INTERRUPT.
  PCBD .... $33.95 KIT $124.95

* **QMB-12** 13 SLOT MOTHER BOARD.
  PCBD .... $42.95 KIT $125.95

* **QMB-9** 9 SLOT MOTHER BOARD.
  PCBD .... $35.95 KIT $109.95

* **PTB-1** POWER SUPPLY AND TERMINATOR BOARD.
  PCBD .... $29.95 KIT $49.95

* **RTC-1** REAL TIME CLOCK BOARD WITH TWO INTERRUPTS.
  PCBD .... $29.95 KIT $79.95

* **MEM-1A** 8K RAM, USES 2102's.
  PCBD .... $33.95 KIT (LESS RAM) $71.95

* **IOB-1** I/O BOARD. ONE SERIAL, TWO PARALLEL WITH CASSETTE. PCBD $33.95

* **FDC-1A** FLOPPY DISC CONTROLLER BOARD USES 1771. PCBD $45.95

FUTURE PRODUCTS: 80 CHARACTER VIDEO BOARD.
8 PARALLEL PORT I/O BOARD.

DEALER INQUIRIES INVITED, UNIVERSITY DISCOUNTS AVAILABLE
AT YOUR LOCAL DEALER

WMC inc.

WAMECO, INC., P. O. BOX 877 • EL GRANADA, CA 94018 • (415) 728-9114

CALIFORNIA COMPUTER SYSTEMS

S100

2032 32K STATIC RAM A & T.
450 NSEC...$579.00, 300 NSEC...$585.00, 200 NSEC...$629.00

2116 16K STATIC RAM A & T.
450 NSEC...$285.00, 300 NSEC...$289.00, 200 NSEC...$329.00

2065 64K DYNAMIC RAM A & T.	$548.95
2200 S-100 MAIN FRAM A & T	$379.95
2422 FLOPPY DISC WITH CP/M 2.2™	$329.95
2802 6502 PROCESSOR A & T.	$282.95
2810A Z80 CPU A & T.	$249.95
2710A 4 SERIAL 1/0 A & T.	$291.95
2718A 2 SERIAL, 2 PARALLEL A & T.	$305.95
2720A 4 PARALLEL A & T.	$214.95
PROTO BOARDS WW .... $39.95, SOLDERTAIL	$29.95

APPLE PRODUCTS

7114A 12K ROM/PROM	$68.50
7424A CALENDAR/CLOCK	$106.95
7440A PROGRAMMABLE TIMER	$98.50
7470A A TO O CONVERTER	$105.95
7490A GPIB (IE 488) INTERFACE	$265.95
7710A ASYNC SERIAL	$125.95
7712A SYNC SERIAL	$153.95
7720A PARALLEL STANDARD	$98.95
7720B PARALLEL CENTRONICS	$98.95
7811B ARITHMETIC PROCESSOR W/DISC	$342.95
7811C ARITHMETIC PROCESSOR W/ROM	$342.95
7500A WW BOARD	$22.95
7510A SOLDERTAIL BOARD	$23.95

SOFTWARE

2610 CP/M™ MACRO ASSEMBLER ON DISK	$76.95
2620 CP/M™ SYMBOLIC INSTRUCTION DEBUGGER	$64.25
2630 CP/M™ TEXT FORMATER	$64.25
2640 CP/M™ BACKGROUND PRINT UTILITY	$42.95

OTHER CCS PRODUCTS ARE AVAILABLE.
CALL FOR PRICE.

SSM MICROCOMPUTER PRODUCTS

S100 PRODUCTS

CBIA 8080 PROCESSOR PCBD $32.95
KIT .... $155.95, A & T $215.95

CB-2 Z80 PROCESSOR BOARD.
KIT .... $198.95, A & T $269.95

VBIC 64 x 16 VIDEO, PCBD $32.95
KIT .... $153.95, A & T $199.95

VB2 64 x 16 VIDEO, PCBD $32.95
KIT .... $175.95, A & T $234.95

VB3 80 CHARACTER VIDEO 4MHZ.
KIT .... $345.95, A & T $425.95

UPGRADE RAMS FOR VB-3 .... $42.00

I04 2 PARALLEL, 2 SERIAL, PCBD $32.95
KIT .... $155.95, A & T $194.95

PB-1 2708, 2716 PROGRAMMER BOARD.
KIT .... $135.95, A & T $185.95

MB-10 16K STATIC RAM.
KIT............ $299.95, A & T............ $339.95

APPLE PRODUCTS

A488 IEEE 488 INTERFACE $399.95

AIO SERIAL/PARALLEL INTERFACE.
KIT .... $125.95, A & T $155.95

ASIO SERIAL I/O
KIT .... $87.95, A & T $97.95

APIO PARALLEL 10
KIT (W/O CABLES) ... $67.95, A & T (W/O CABLES) ... $87.95

OTHER SSM PRODUCTS ARE AVAILABLE.
CALL FOR PRICES.

MIKOS

MONDAY-FRIDAY, 8:00 TO 12:00, 1:00 TO 5:30
THURSDAYS, 8:00 TO 9:00 P.M.
(415) 728-9121
P.O. BOX 955 • EL GRANADA, CA 94018
PLEASE SEND FOR IC, XISTOR AND COMPUTER PARTS LIST

DEC. SPECIAL SALE ON PREPAID ORDERS

(CHARGE CARDS AND C O D OR P O **NOT** AVAILABLE ON THESE OFFERS)

XMAS SALE
5% OFF OF CCS AND SSM PCBD AND KITS.
7½% OFF OF WAMECO PCBD'S AND KITS.

WMC inc. **WAMECO INC.**
BOARDS WITH MIKOS PARTS

MEM-3 32K STATIC RAM, PCBD................ $36.95
KIT LESS RAM .... $95.95, A & T $135.95

CPU-2 Z80 PROCESSOR, PCBD................ $32.95
KIT LESS ROM........ $109.95, A & T........ $149.95

EPM-2 16K/32K EPROM, PCBD................ $32.95
KIT LESS ROM......... $65.95, A & T......... $99.95

FPB-1 FRONT PANEL, PCBD $48.50
KIT .... $144.95, A & T $184.95

CPU-1 8080 PROCESSOR, PCBD................ $29.95
KIT............ $89.95, A & T............ $129.95

QMB-12 13 SLOT MOTHER BOARD, PCBD........ $39.95
KIT............ $95.95, A & T............ $135.95

OTHER WAMECO PRODUCTS ARE AVAILABLE.
CALL FOR PRICES.

MIKOS PARTS ASSORTMENTS ARE ALL FACTORY MARKED PARTS KITS INCLUDE ALL PARTS LISTED AS REQUIRED FOR THE COMPLETE KIT LESS PARTS LISTED ALL SOCKETS INCLUDED

LARGE SELECTION OF LS TTL AVAILABLE.
PURCHASE $50.00 WORTH OF LS TTL AND GET 10% CREDIT TOWARD ADDITIONAL PURCHASES. PREPAID ORDERS ONLY.

VISA or MASTERCHARGE Send account number, interbank number, expiration date and sign your order. Approx. postage will be added. Check or money order will be sent post paid in U.S. If you are not a regular customer, please use charge, cashier's check or postal money order. Otherwise there will be a two-week delay for checks to clear. Calif residents add 6% tax. Money back 30-day guarantee. We cannot accept returned IC's that have been soldered to. Prices subject to change without notice. **$10 minimum order. $1.50 service charge on orders less than $10.00.**

The Best Boards
SD Prices Slashed !!!

Single User System

SBC-200, 64K ExpandoRAM II, Versafloppy II, CP/M 2.2

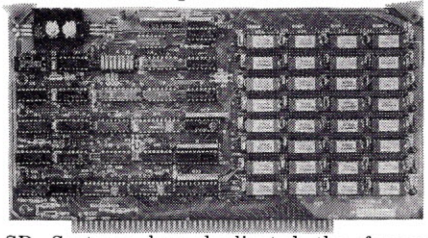
$995.00

4 MHz Z-80A CPU, 64K RAM, serial I/O port, parallel I/O port, double-density disk controller, CP/M 2.2 disk and manuals, system monitor, control and diagnostic software.

-All boards are assembled and tested-

ExpandoRAM III

64K to 256K expandable RAM board



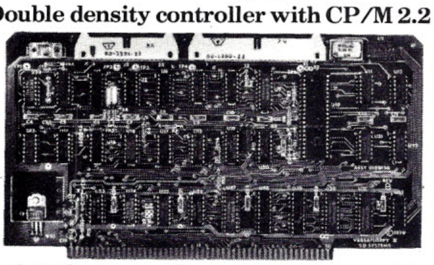
SD Systems has duplicated the famous reliability of their ExpandoRAM I and II boards in the new ExpandoRAM III, a board capable of containing 256K of high speed RAM. Utilizing the new 64K x 1 dymanic RAM chips, you can configure a memory of 64K, 128K, 192K, or 256K, all on one S-100 board. Memory address decoding is done by a programmed bipolar ROM so that the memory map may be dip-switch configured to work with either COSMOS/MPM-type systems or with OASIS-type systems.

Extensive application notes concerning how to operate the ExpandoRAM III with Cromemco, Intersystems, and other popular 4 MHz Z-80 systems are contained in the manual.

MEM-65064A *64K A & T* **$495.00**
MEM-65128A *128K A & T* **$639.95**
MEM-65192A *192K A & T* **$769.95**
MEM-65256A *256K A & T* **$879.95**

Versafloppy II

Double density controller with CP/M 2.2



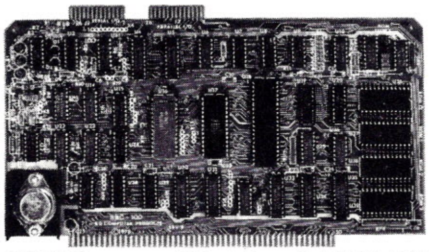
• S-100 bus compatible • IBM 3740 compatible soft sectored format • Controls single and double-sided drives, single or double density, 5¼″ and 8″ drives in any combination of four simultaneously • Drive select and side select circuitry • Analog phase-locked loop data seperator • Vectored interrupt operation optional • CP/M 2.2 disk and manual set included • Control/diagnostic software PROM included

The Versafloppy II is faster, more stable and more tolerant of bit shift and "jitter" than most controllers. CP/M 2.2 and all necessary control and diagnostic software are included.

IOD-1160A *A & T with CP/M 2.2* .. **$370.00**

SBC-200

2 or 4 MHz single board computer



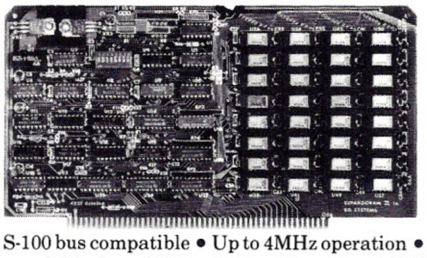
• S-100 bus compatible • Powerful 4MHz Z-80A CPU • Synchronous/asynchronous serial I/O port with RS-232 interface and software programmable baud rates up to 9600 baud • Parallel input and parallel output port • Four channel counter/timer • Four maskable, vectored interrupt inputs and a non-maskable interrupt • 1K of on-board RAM • Up to 32K of on-board ROM • System monitor PROM included

The SBC-200 is an excellent CPU board to base a microcomputer system around. With on-board RAM, ROM, and I/O, the SBC-200 allows you to build a powerful three-board system that has the same features found in most five-board microcomputers. The SBC-200 is compatible with both single-user and multi-user systems.

CPU-30200A *A & T with monitor* . **$299.95**

ExpandoRAM II

16K to 64K expandable RAM board



• S-100 bus compatible • Up to 4MHz operation • Expandable from 16K to 64K • Uses 16 x 1 4116 memory chips • Page mode operation allows up to 8 memory boards on the bus • Phantom output disable • Invisible on-board refresh

The ExpandoRAM II is compatible with most S-100 CPUs. When other SD System' series II boards are combined with the ExpandoRAM II, they create a microcomputer system with exceptional capabilities and features.

MEM-16630A *16K A & T* **$325.00**
MEM-32631A *32K A & T* **$345.00**
MEM-48632A *48K A & T* **$365.00**
MEM-64633A *64K A & T* **$385.00**

COSMOS

Multi-user operating system

• Multi-user disk operating system • Allows up to 8 users to run independent jobs concurrently • Each user has a seperate file directory

COMOS supports all the file structures of CP/M 2.2, and is compatible at the applications program level with CP/M 2.2, so that most programs written to run under CP/M 2.2 or SDOS will also run under COSMOS.

SFC-55009039F *COSMOS on 8″ disk* **$395.00**

Multi-User System

SBC-200, 256K ExpandoRAM III, Versafloppy II, MPC-4
COSMOS Multi-User Operating System, C BASIC II

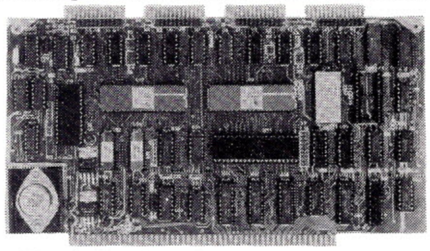
$1995.00

Two Z-80A CPUs (4 MHz), 256K RAM, 5 serial I/O ports with independently programmable baud rates and vectored interrupts, parallel input port, parallel output port, 8 counter/timer channels, real time clock, single and double sided/single or double density disk controller for 5¼″ and 8″ drives, up to 36K of on-board ROM, CP/M 2.2 compatible COSMOS interrupt driven multi-user disk operating system, allows up to 8 users to run independent jobs concurrently, C BASIC II, control and diagnostic software in PROM included.

-All boards are assembled and tested-

MPC-4

Intelligent communications interface



• Four buffered serial I/O ports • On-board Z-80A processor • Four CTC channels • Independently programmable baud rates • Vectored interrupt capability • Up to 4K of on-board PROM • Up to 2K of on-board RAM • On-board firmware

This is not just another four-port serial I/O board! The on-board processor and firmware provide sufficient intelligence to allow the MPC-4 to handle time consuming I/O tasks, rather than loading down your CPU. To increase overall efficiency, each serial channel has an 80 character input buffer and a 128 character output buffer. The on-board firmware can be modified to make the board SDLC or BISYNC compatible. In combination with SD's COSMOS operating system (which is included with the MPC-4), this board makes a perfect building block for a multi-user system.

IOI-1504A *A & T with COSMOS* .. **$495.00**

Place Orders Toll Free

Continental U.S.	*Inside California*
800-421-5500	**800-262-1710**

For Technical Inquires or Customer Service call:
213-973-7707

JADE ✓48
Computer Products

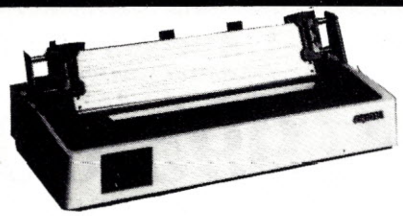
4901 W. Rosecrans, Hawthorne, Ca 90250

TERMS of SALE: Cash, checks, credit cards, or Purchase Orders from qualified firms and institutions. **Minimum Order $15.00.** California residents add 6% tax. Minimum shipping & handling charge $3.00. **Pricing & availibility subject to change**

JADE
Computer Products

48

Printers



BETTER THAN EPSON ! - Okidata

Microline 82A *80/132 column,* ***120 CPS****, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (removable), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking, both serial & parallel interfaces included, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*

PRM-43082 *with FREE tractor* **$539.95**

Microline 83A *132/232 column, 120 CPS, handles forms up to 15" wide, plus all the features of the 82A.*

PRM-43083 *with FREE tractor* **$749.95**

PRA-27081A *Apple card* **$39.95**
PRA-27082A *Apple cable* **$19.95**
PRA-27087A *TRS-80 cable* **$24.95**
PRA-43080 *Extra ribbons pkg. of 2* ... **$9.95**

INEXPENSIVE PRINTERS - Epson

MX-70 *80 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*

PRM-27070 *List $459* **$399.95**

MX-80 *80 column, 80 CPS, bi-directional/logic seeking printing, 9 x 9 dot matrix, adjustable tractor feed, & 64 graphics characters*

PRM-27080 *List $645* **$469.95**

MX-80FT *same as MX-80 with friction feed added.*

PRM-27082 *List $745* **$559.95**

MX-100 *132 column, correspondence quality, graphics, up to 15" paper, friction feed & adjustable tractor feed, 9 x 9 dot matrix, 80 CPS.*

PRM-27100 *List $945* **$759.95**

PRA-27084 *Serial interface* **$69.95**
PRA-27088 *Serial intf & 2K buffer* .. **$144.95**
PRA-27081 *Apple card* **$74.95**
PRA-27082 *Apple cable* **$22.95**
PRA-27086 *IEEE 488 card* **$52.95**
PRA-27087 *TRS-80 cable* **$32.95**
PRA-27085 *Graftrax II* **$95.00**
PRA-27083 *Extra ribbon* **$14.95**

NEC 7700 & 3500

NEC Spinwriter w/Intelligent Controller

Standard serial, Centronics parallel, and current loop interfaces • Selectable baud rates 50 to 19,200 • Automatic bidirectional printing • Logic seeking • 650 character buffer with optional 16K buffer • 55 characters per second print speed • Comes with vertical forms tractor, ribbon, thimble and cable • Diablo compatible software • Available with or without optional front panel

PRD-55511 *1K no front panel* **$2795.00**
PRD-55512 *16K no front panel* .. **$2895.00**
PRD-55515 *1K w/front panel* **$2995.00**
PRD-55516 *16K w/front panel* ... **$3095.00**

Intersell NEC 3500Q

New from NEC - the 3500 series Spinwriters. Incorporates all the features and reliability of the 5500 and 7700 series Spinwriters into an inexpensive 30 CPS letter quality printer with an optional bi-directional tractor assembly.

PRD-55351 *3500Q 1K* **$1995.00**
PRD-55352 *3500Q 16K* **$2095.00**
PRA-55100 *Deluxe tractor option* .. **$300.00**

Accessories for Apple

16K MEMORY UPGRADE

Add 16K of RAM to your TRS-80, Apple, or Exidy in just minutes. We've sold thousands of these 16K RAM upgrades which include the appropriate memory chips (as specified by the manufacturer), all necessary jumper blocks, fool-proof instructions, and our 1 year guarantee.

MEX-16100K *TRS-80 kit* **$25.00**
MEX-16101K *Apple kit* **$25.00**
MEX-16102K *Exidy kit* **$25.00**

16K RAM CARD - for Apple II

Expand your Apple to 64K, 1 year warranty

MEX-16500A *Save $70.00 !!!* **$129.95**

Z-80* CARD for APPLE

Two computers in one, Z-80 & 6502, more than doubles the power & potential of your Apple, includes Z-80 CPU card, CP/M 2.2, & BASIC-80*

CPX-30800A *A & T* **$299.95**

8" DISK CONTROLLER

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CPM 2.2, Shugart & Qume compatible

IOD-2700A *A & T* **$499.95**

2 MEGABYTES for Apple II

Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package *(Kit)* **$1495.00**
1 MegaByte Package *(A & T)* **$1695.00**
2 MegaByte Package *(Kit)* **$1795.00**
2 MegaByte Package *(A & T)* **$19.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A *A & T* **$199.95**

AIO, ASIO, APIO - S.S.M.

Parallel & serial interface for your Apple (see Byte pg 11)

IOI-2050K *Par & Ser kit* **$139.95**
IOI-2050A *Par & Ser A & T* **$169.95**
IOI-2052K *Serial kit* **$89.95**
IOI-2052A *Serial A & T* **$99.95**
IOI-2054K *Parallel kit* **$69.95**
IOI-2054A *Parallel A & T* **$89.95**

A488 - S.S.M.

IEEE 488 controller, uses simple basic commands, includes firmware and cable, 1 year guarantee, (see April Byte pg 11)

IOX-7488A *A & T* **$399.95**

Modems

CAT MODEMS - Novation

CAT *300 baud, acoustic, answer/orginate*

IOM-5200A *List $189.95* **$149.95**

D-CAT *300 baud direct connect, answer/orginate*

IOM-5201A *List $199.95* **$169.95**

AUTO-CAT *Auto answer/orginate, direct connect*

IOM-5230A *List $299.95* **$239.95**

Apple-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer auto-dial, auxiliary 3-wire RS232C serial port for printer.

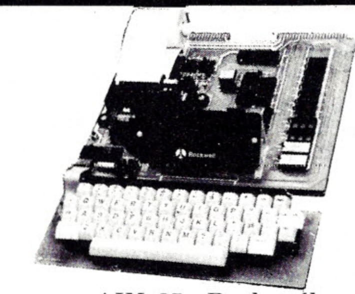
IOM-5232A *Save $50.00!!!* **$325.00**

SMARTMODEM - Hayes

Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable

IOM-5400A *Smartmodem* **$269.95**

Single Board Computer



AIM-65 - Rockwell

6502 computer with alphanumeric display, printer, & keyboard, and complete instructional manuals

CPK-50165 *1K AIM* **$424.95**
CPK-50465 *4K AIM* **$474.95**
SFK-74600008E *8K BASIC ROM* .. **$64.95**
SFK-64600004E *4K assembler ROM* **$43.95**
PSX-030A *Power supply* **$64.95**
ENX-000002 *Enclosure* **$54.95**

4K AIM, 8K BASIC, power supply, & enclosure

Special package price **$649.95**

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook

CPS-30100K *KIT* **$299.95**
CPS-30100A *A & T* **$469.95**

SYM-1 - Synertek Systems

Single board computer with 1K of RAM, 4K of ROM, key-pad, LED display, 20ma & cassette interface on board.

CPK-50020A *A & T* **$249.95**

Video Monitors

HI-RES 12" GREEN - Zenith

15 MHz bandwidth, 700 lines/inch, P31 green phosphor, switchable 40 or 80 columns, small, light-weight & portable.

VDM-201201 *List price $150.00* **$118.95**

Leedex / Amdek

Reasonably priced video monitors

VDM-801210 *Video 100 12" B&W* .. **$139.95**
VDM-801230 *Video 100-80 12" B& W* **$179.95**
VDM-801250 *12" Green Phospor* **$169.95**
VDC-801310 *13" Color I* **$379.95**

12" COLOR MONITOR - NEC

Hi-res monitor with audio & sculptured case

VDC-651212 *Color Monitor* **$479.95**

12" GREEN SCREEN - NEC

20 MHz, P31 phosphor video monitor with audio, exceptionally high resolution - A fantastic monitor at a very reasonable price

VDM-651200 *Special Sale Price* **$199.95**

Video Terminals

AMBER SCREEN - Volker Craig

Detachable keyboard, amber on black display, 7 x 9 dot matrix, 10 program function keys, 14 key numeric pad, 12" non-glare screen, 50 to 19,200 baud, direct cursor control, auxiliary bi-directional serial port

VDT-351200 *List $795.00* **$645.00**

VIEWPOINT - ADDS

Detachable keyboard, serial RS232C interface, baud rates from 110 to 19,200, auxiliary serial output port, 24 x 80 display.

VDT-501210 *Sale Priced* **$639.95**

TELEVIDEO 950

VDT-901250 *List $1195.00* **$995.00**

DIALOGUE 80 - Ampex

VDT-230080 *List $1195.00* **$895.00**

JADE

Computer Products

S-100 CPU Boards

THE BIG Z* - Jade

2 or 4 MHz switchable Z-80 CPU with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600*

CPU-30201K *Kit* **$139.95**
CPU-30201A *A & T* **$189.95**
CPU-30200B *Bare board* **$35.00**

2810 Z-80* CPU - Cal Comp Sys

2/4 MHz Z-80A CPU with RS-232C serial I/O port and on-board MOSS 2.2 monitor PROM, front panel compatible.*

CPU-30400A *A & T* **$269.95**

CB-2 Z-80 CPU - S.S.M.

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K *Kit* **$239.95**
CPU-30300A *A & T* **$299.95**

S-100 PROM Boards

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer w/software

MEM-99520K *Kit* **$189.95**
MEM-99520A *A & T* **$249.95**

PB-1 - S.S.M.

2708, 2716 EPROM board with built-in programmer

MEM-99510K *Kit* **$154.95**
MEM-99510A *A & T* **$219.95**

EPROM BOARD - Jade

16K or 32K uses 2708's or 2716's, 1K boundary

MEM-16230K *Kit* **$79.95**
MEM-16230A *A & T* **$119.95**

S-100 Video Boards

VB-3 - S.S.M.

80 characters x 24 lines expandable to 80 x 48 for a full page of text, upper & lower case, 256 user defined symbols, 160 x 192 graphics matrix, memory mapped, has key board input.

IOV-1095K *4 MHz kit* **$349.95**
IOV-1095A *4 MHz A & T* **$439.95**
IOV-1096K *80 x 48 upgrade* **$39.95**

VDB-8024 - SD Systems

80 x 24 I/O mapped video board with keyboard I/O, and on-board Z-80A.*

IOV-1020A *A & T* **$459.95**

VIDEO BOARD - S.S.M.

64 characters x 16 lines, 128 x 48 matrix for graphics, full upper/lower case ASCII character set, numbers, symbols, and greek letters, normal/reverse/blinking video, S-100.

IOV-1051K *Kit* **$149.95**
IOV-1051A *A & T* **$219.95**
IOV-1051B *Bare board* **$34.95**

S-100 Motherboards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

6 Slot (5¼" x 8⅝")

MBS-061B *Bare board* **$19.95**
MBS-061K *Kit* **$39.95**
MBS-061A *A & T* **$49.95**

12 Slot (9¾" x 8⅝")

MBS-121B *Bare board* **$29.95**
MBS-121K *Kit* **$69.95**
MBS-121A *A & T* **$89.95**

18 Slot (14½" x 8⅝")

MBS-181B *Bare board* **$49.95**
MBS-181K *Kit* **$99.95**
MBS-181A *A & T* **$139.95**

S-100 RAM Boards

MEMORY BANK - Jade

4 MHz, S-100, bank selectable, expandable from 16K to 64K

MEM-99730B *Bare Board* **$49.95**
MEM-99730K *Kit no RAM* **$199.95**
MEM-32731K *32K Kit* **$239.95**
MEM-64733K *64K Kit* **$279.95**
Assembled & Tested .... add **$50.00**

64K RAM - Calif Computer Sys

4 MHz bank port / bank byte selectable, extended addressing, 16K bank selectable, PHANTOM line allows memory overlay, 8080 / Z-80 / front panel compatible.

MEM-64565A *A & T* **$575.00**

64K STATIC RAM - Mem Merchant

64K static S-100 RAM card, 4-16K banks, up to 8MHz

MEM-64400A *A & T* **$789.95**

32K STATIC RAM - Jade

2 or 4 MHz expandable static RAM board uses 2114L's

MEM-16151K *16K 4 MHz kit* **$169.95**
MEM-32151K *32K 4 MHz kit* **$299.95**
Assembled & tested .... add **$50.00**

16K STATIC RAM - Mem Merchant

4 MHz 16K static RAM board, IEEE S-100, bank selectable, Phantom capability, addressable in 4K blocks, "disable-able" in 1K segments, extended addressing, low power

MEM-16171A *A & T* **$164.95**

S-100 Disk Controllers

DOUBLE-D - Jade

Double density controller with the inside track, on-board Z-80A, printer port, IEEE S-100, can function on an interrupt driven buss*

IOD-1200K *Kit* **$299.95**
IOD-1200A *A & T* **$375.00**
IOD-1200B *Bare board* **$59.95**

DOUBLE DENSITY - Cal Comp Sys

5¼" and 8" disk controller, single or double density, with on-board boot loader ROM, and free CP/M 2.2 and manual set.*

IOD-1300A *A & T* **$374.95**

S-100 I/O Boards

S.P.I.C. - Jade

Our new I/O card with 2 SIO's, 4 CTC's, and 1 PIO

IOI-1045K *2 CTC's, 1 SIO, 1 PIO* .. **$179.95**
IOI-1045A *A & T* **$239.95**
IOI-1046K *4 CTC's, 2 SIO's, 1 PIO* **$219.95**
IOI-1046A *A & T* **$299.95**
IOI-1045B *Bare board w/ manual* ... **$49.95**

I/O-4 - S.S.M.

2 serial I/O ports plus 2 parallel I/O ports

IOI-1010K *Kit* **$179.95**
IOI-1010A *A & T* **$249.95**
IOI-1010B *Bare board* **$35.00**

S-100 Mainframes

MAINFRAME - Cal Comp Sys

12 slot S-100 mainframe with 20 amp power supply

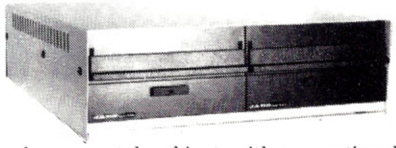
ENC-112105 *Kit* **$329.95**
ENC-112106 *A & T* **$399.95**

DISK MAINFRAME - N.P.C.

Holds 2 8" drives and a 12 slot S-100 system. Attractive metal cabinet with 12 slot motherboard & card cage, power supply, dual fans, lighted switch, and other professional features

ENS-112325 *with 25 amp p.s.* **$699.95**

Disk Drives



Handsome metal cabinet with proportionally balanced air flow system • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

Dual 8" Subassembly Cabinet

END-000420 *Bare cabinet* **$59.95**
END-000421 *Cabinet kit* **$225.00**
END-000431 *A & T* **$359.95**

8" Disk Drive Subsystems
Single Sided, Double Density

END-000423 *Kit w/2 FD100-8Ds* . **$924.95**
END-000424 *A & T w/2 FD100-8Ds* **$1124.95**
END-000433 *Kit w/2 SA-801Rs* ... **$999.95**
END-000434 *A & T w/2 SA-801Rs* **$1195.00**

8" Disk Drive Subsystems
Double Sided, Double Density

END-000426 *Kit w/2 DT-8s* **$1224.95**
END-000427 *A & T w/2 DT-8s* ... **$1424.95**
END-000436 *Kit w/2 SA-851Rs* .. **$1495.00**
END-000437 *A & T w/2 SA-851Rs* **$1695.00**

QUME DT-8

8" Double-Sided, Double-Density Disk Drive

1 Drive ... $524.95 each
2 Drives . $499.95 each
10 Drives $479.95 each

Jade Part Number MSF-750080

Shugart 801R

8" Single-Sided, Double-Density Disk Drive

1 Drive ... $394.95 each
2 Drives . $389.95 each

Jade Part Number MSF-10801R

SIEMENS 8"

8" Single-Sided, Double-Density Disk Drive

1 Drive ... $384.95 each
2 Drives . $349.95 each
10 Drives $324.95 each

Jade Part Number MSF-201120

MPI B-51

5¼" Single-Sided, Double-Density Disk Drive

1 Drive ... $234.95 each
2 Drives . $224.95 each
10 Drives $219.95 each

Jade Part Number MSM-155100

END-000213 *Case & power supply* **$74.95**

Why use their flexible discs:

Athana, BASF, Control Data, Dysan, IBM, Maxell, Nashua, Scotch, Shugart, Syncom, 3M, Verbatim or Wabash

when you could be using

MEMOREX

for as low as $1.94 each?

Find the flexible disc you're now using on our cross reference list...
then write down the equivalent Memorex part number you should be ordering.

Product Family	Product Description	Memorex Part Number (3201-)	CE quant. 100 price per disc ($)	Athana	BASF	Dysan	IBM	Maxell	Nashua	Scotch 3M	Shugart	Syncom	Verbatim	Wabash	Control Data
	IBM Compatible (128 B/S, 26 Sectors)	3060	1.99	473071	53428	800506	2305830	FD1-128	FD-1	740-0	S/A 100	15002	FD34-9000	F111111X	421602
Flexible Disc 1s	IBM Compatible (128 B/S, 26 Sectors) w/ W.P.N.	3062	2.04	–	–	–	–	–	–	740-0	–	–	FD34-9000	–	–
Single-Headed Drives	IBM Compatible (128 B/S, 26 Sectors) w/ W.P.N. & Hub Ring	3064	2.39	–	–	–	–	–	–	–	–	–	FD34-9000	–	–
Single-Density Media	IBM Compatible (128 B/S, 26 Sectors) REVERSIBLE	1729	3.19	473072	54431	–	–	–	FD-2	740/2-0	–	15150	FF34-9000	F171111X	–
	IBM System 6 Compatible	3066	2.04	473077	54561	800509	1669959	–	–	740-0 0S6	–	15003	FD60-9000	F116111X	–
	IBM Compatible (256 B/S, 15 Sectors)	3109	1.99	473073	–	800584	2305845	–	–	740-3600	–	15005	FD36-9000	F112111X	–
	IBM Compatible (512 B/S, 8 Sectors)	3110	1.99	473074	–	800585	1669954	–	–	–	–	15004	FD60-9000	F113111X	–
	Shugart Compatible, 32 Hard Sector	3015	1.99	470901	53802	101/1	–	FH1-32	FD-132	740-32	S/A-101	15025	FD32-9000	–	421322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3087	2.49	–	54491	–	–	–	–	740-32RH	–	–	–	F37A411X	–
	CPT 8000 Compatible	3045	2.69	–	–	–	–	–	–	–	–	15226	–	–	–
Flexible Disc 1d	IBM Compatible (128 B/S, 26 Sectors)	3090	2.69	474071	54566	3740/1D	–	FD1-128/M2100	FD-1D	741-0	–	–	FD34-8000	F131111X	423002
Single-Headed Drives	Soft Sector (128 B/S, 26 Sectors) REVERSIBLE	3093	3.69	–	–	–	–	–	–	–	–	–	–	–	–
Double-Density Media	Shugart Compatible, 32 Hard Sector	3091	2.69	470801	54596	101/1D	–	FH1-32D	–	741-32	S/A-103	15075	FD32-8000	F33A411X	423322
	Wang Compatible, 32 Hard Sector w/Hub Ring	3088	3.09	–	–	–	–	–	–	–	–	–	–	–	–
Flexible Disc 2s	Soft Sector (128 B/S, 26 Sectors)	3113	3.09	–	54428	800814	1766870	–	–	–	S/A-150	15153	FD10-4026	F121111X	–
Double-Headed Drives	Soft Sector (256 B/S, 15 Sectors)	3106	3.09	473477	54226	800815	2736700	FD2-256D	–	742-0	–	15154	FD10-4015	F122111X	424612
Single-Density Media															
Flexible Disc 2d	Soft Sector (Unformatted)	3102	3.09	473485	–	DY150	–	FD2-XDM	FD-2D	743-0	–	15103	DD34-4001	–	425002
Double-Headed Drives	Soft Sector (128 B/S, 26 Sectors)	3115	3.09	–	–	–	–	–	–	–	S/A-150	–	–	–	–
Double-Density Media	Soft Sector (256 B/S, 26 Sectors)	3103	3.09	473471	54325	800817	1766872	FD2-256D	–	743-0/256	–	15101	DD34-4026	F144111X	425602
	Soft Sector (512 B/S, 15 Sectors)	3114	3.09	473472	54479	800818	1669044	–	–	743-0/512	–	15100	DD34-4015	F145111X	425612
	Soft Sector (1024 B/S, 8 Sectors)	3104	3.09	473473	54485	800819	1669045	–	–	743-0/1024	–	15102	DD34-4008	F147111X	425622
	32 Hard Sector	3105	3.09	470851	–	101/2D	–	FH2-32D	–	743-32	S/A-151	15125	DD32-4000	F34A411X	425322
	Burroughs B-80 Compatible, 32 Hard Sector	3092	3.09	–	–	–	–	–	–	–	–	–	–	F34A611X	–
	Soft Sector (1024 B/S, 8 Sectors) w/ Hub Ring	3116	3.49	–	–	–	–	–	–	–	–	–	–	–	–
	Shugart Compatible, 32 Hard Sector	3181	3.39	–	–	–	–	–	–	–	–	–	DD32-4000	–	–
Flexible Disc FD Memorex 651 or Equiv. Drive Compatible	FD VI (Vinyl Jacket)	30712003	2.69	470651	–	FDIV	–	–	FD-165	511-0	–	15026	FD65-1000	F61A111X	–
Mini Flexible Disc 1s	Soft Sector (Unformatted)	3401	1.94	475001	54256	104/1	–	MD1	MD 1	744-0	S/A-104	15300	MD525-01	M11A211X	441002
5¼" Single-Headed Drives	10 Hard Sector	3403	1.94	475010	54257	107/1	–	–	MD 110	744-10	S/A-107	15325	MD525-10	M41A211X	441102
Single-Density Media	16 Hard Sector	3405	1.94	475016	54258	105/1	–	MH1	MD 116	744-16	S/A-105	15326	MD525-16	M51A211X	441162
	Soft Sector (Unformatted) w/Hub Ring	3431	2.14	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector, w/Hub Ring	3433	2.14	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector, w/Hub Ring	3435	2.14	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 1d	Soft Sector (Unformatted)	3417	2.14	–	54646	104/1D	–	–	–	–	–	–	MD525-01	–	–
5¼" Single-Headed Drives	10 Hard Sector	3418	2.14	–	54649	107/1D	–	–	–	–	–	–	MD525-10	–	–
Double-Density Media	16 Hard Sector	3419	2.14	–	54652	105/1D	–	–	–	–	–	–	MD525-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3481	2.34	–	–	–	–	–	–	–	–	–	MD525-01	–	–
	10 Hard Sector w/Hub Ring	3483	2.34	–	–	–	–	–	–	–	–	–	MD525-10	–	–
	16 Hard Sector w/Hub Ring	3485	2.34	–	–	–	–	–	–	–	–	–	MD525-16	–	–
Mini Flexible Disc 2d	Soft Sector (Unformatted)	3421	2.59	–	54624	104/2D	–	–	–	–	S/A-154	–	MD550-01	–	–
5¼" Double-Headed Drives	10 Hard Sector	3423	2.59	–	54627	107/2D	–	–	–	–	S/A-157	–	MD550-10	–	–
Double Density Media	16 Hard Sector	3425	2.59	–	54630	105/2D	–	–	–	–	S/A-155	–	MD550-16	–	–
	Soft Sector (Unformatted) w/Hub Ring	3491	2.79	–	–	–	–	–	–	–	–	–	MD550-01	–	–
	10 Hard Sector w/Hub Ring	3493	2.79	–	–	–	–	–	–	–	–	–	MD550-10	–	–
	16 Hard Sector w/Hub Ring	3495	2.79	–	–	–	–	–	–	–	–	–	MD550-16	–	–

Memorex Flexible Discs...The Ultimate in Memory Excellence

Quality
Memorex means quality products that you can depend on. Quality control at Memorex means starting with the best materials available. Continual surveillance throughout the entire manufacturing process. The benefit of Memorex's years of experience in magnetic media production, resulting, for instance, in proprietary coating formulations. The most sophisticated testing procedures you'll find anywhere in the business.

100 Percent Error Free
Each and every Memorex Flexible Disc is certified to be 100 percent error free. *Each* track of *each* flexible disc is tested, individually, to Memorex's stringent standards of excellence. They test signal amplitude, resolution, low-pass modulation, overwrite, missing pulse error and extra pulse error. They are torque-tested, and competitively tested on drives available from almost every major drive manufacturer in the industry including drives that Memorex manufactures. Rigid quality audits are built into every step of the manufacturing process and stringent testing result in a standard of excellence that assures you, our customer, of a quality product designed for increased data reliability and consistent top performance.

Customer-Oriented Packaging
Memorex's commitment to excellence does not stop with a quality product. They are proud of their flexible discs and they package them with pride. Both their packaging and their labeling have been designed with your ease of identification and use in mind. The desk-top box containing ten discs is convenient for filing and storage. Both box labels and jacket labels provide full information on compatibility, density, sectoring, and record length. Envelopes with multi-language care and handling instructions and color-coded removable labels are included. A write-protect feature is available to provide data security.

Full One Year Warranty — Your Assurance of Quality
Memorex Flexible Discs will be replaced by Memorex if they are found to be defective in materials or workmanship within one year of the date of purchase. Other than replacement, Memorex will not be responsible for any damages or losses (including consequential damages) caused by the use of Memorex Flexible Discs.

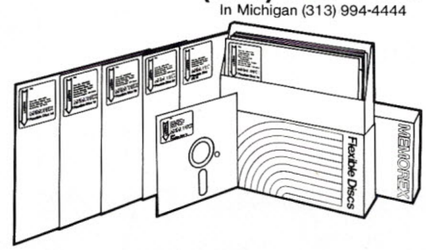
Quantity Discounts Available
Memorex Flexible Discs are packed 10 discs to a carton and 10 cartons to a case. Please order only in increments of 100 units for quantity 100 pricing. We are also willing to accommodate your smaller orders. Quantities less than 100 units are available in increments of 10 units at a 10% surcharge. **Quantity discounts** are also available. Order 500 or more discs at the same time and deduct 1%; 1,000 or more saves you 2%; 2,000 or more saves you 3%; 5,000 or more saves you 4%; 10,000 or more saves you 5%; 25,000 or more saves you 6%; 50,000 or more saves you 7% and 100,000 or more discs earns you an 8% discount off our super low quantity 100 price. Almost all Memorex Flexible Discs are immediately available from **CE**. Our warehouse facilities are equipped to help us get you the quality product you need, when you need it. If you need further assistance to find the flexible disc that's right for you, call the Memorex compatibility hotline. Dial 800-538-8080 and ask for the *flexible disc hotline* extension 0997. In California dial 800-672-3525 extension 0997.

Buy with Confidence
To get the fastest delivery from **CE** of your Memorex Flexible Discs, send or phone your order directly to our Computer Products Division. Be sure to calculate your price using the **CE** prices in this ad. Michigan residents please add 4% sales tax. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. All sales are final. Prices, terms and specifications are subject to change without notice. Out of stock items will be placed on backorder automatically unless **CE** is instructed differently. Minimum order $50.00. International orders are invited with a $20.00 surcharge for special handling in addition to shipping charges. All shipments are F.O.B. Ann Arbor, Michigan. No COD's please. Non-certified and foreign checks require bank clearance.

Mail orders to: **Communications Electronics**, Box 1002, Ann Arbor, Michigan 48106 U.S.A. Add $8.00 per case or partial-case of 100 8-inch discs or $6.00 per case of 100 5¼-inch mini-discs for U.P.S. *ground* shipping and handling in the continental U.S.A. If you have a Master Card or Visa card, you may call anytime and place a credit card order. **Order toll-free** in the United States. Call anytime 800-521-4414. If you are outside the U.S. or in Michigan, dial 313-994-4444. **Dealer inquiries invited.** All order lines at **Communications Electronics** are staffed 24 hours.

MEMBER
DIRECT MAIL MARKETING ASSOCIATION
CODE OF ETHICS
VISA
MasterCard

Order Toll-Free!
(800) 521-4414
In Michigan (313) 994-4444



For Data Reliability—Memorex Flexible Discs

COMMUNICATIONS ELECTRONICS™ 376

Computer Products Division

854 Phoenix ☐ Box 1002 ☐ Ann Arbor, Michigan 48106 U.S.A.
Call TOLL-FREE (800) 521-4414 or outside U.S.A. (313) 994-4444

B.G. MICRO

P.O. Box 280298 Dallas, Texas 75228
(214) 271-5546
• Visa • MasterCard • American Express •

Terms $1.50 postage, handling, orders over $50.00 add .85 for insurance. Texas residents add 5% sales tax.

STATIC RAM

*21L02-1KX1 250 n.s. Low Power .... .95
2114L-3 1KX4 300 n.s. Low Power... 2.95 8/$22.00
MM5257 (TMS4044) 4KX1 450 n.s. 2.95
HM6116P-4-2KX8 + 5v-200 n.s. CMOS Low Power 2716 Style Pin Out. 14.95 8/$105.00
6514 J-5 1KX4-CMOS Super Low Power Similar to 350 n.s. 2114 Same Pin Out ... 2.95
TMM2016-2KX8 + 5v-NMOS 200 n.s.-2716 Style Pin Out .... 14.95 8/$105.00

DYNAMIC RAM

2107B-4 (MM5280N-5)-4KX1 22 pin 1.59
4027-4KX1-250 n.s. 1.75
*4116-16KX1-300n.s.. 8/ 12.95
*4116-16KX1-200 n.s.. 8/15.95
HM4164- + 5v 64K Dynamic Call or Write For Super Low Prices

EPROM

*Asterik Denotes Super Specials

*1702A	256X8 1 us		2.50
2708	1KX8 450 n.s.		2.95
27A08	1KX8 350 n.s.		3.95
*2716	2KX8 + 5v 450 n.s.		5.95
*2716-1	2KX8 + 5v 350 n.s.		9.95
*2732	4KX8 450 n.s.	Intel Pin Out	14.95
*2532	4KX8 450 n.s.	T.I. Pin Out	14.95

Z-80

Z80A-4MHZ CPU $8.95
Z80PIO-Parallel $5.95
Z80SIO/0-Z-80 2 Chan. Ser. $24.95
*Z80DMA-DMA Controller ... $9.95

80 80 SUPPORT

8216	Buffer	$1.95
8251	USAR	$4.95
8253	Baud Rate Gen.	$8.95

MISCELLANEOUS

*TR1602-UART same as AY5-1013 .... $1.99
*IM6402- + 5v. High speed UART-AY5-1013 pin out $3.95
*MC1488-1489-RS232 Receiver and drive H.#.... pair $1.19
AY3-8910-Sound Chip with 60 page data manual ... $12.95
82S123-32X8 Tri State Bi polar PROM $3.99
*555-timer .... 5/$1.10

BIT SLICE

AMD2901-4Bit Slice $7.95
AMD2903-4 Bit Super Slice $12.95
AMD2911-Sequencer $3.95
AMD29705-16 Register Files $4.95

TTL

7400	.19	7474	.29
7402	.19	7486	.29
7404	.19	74109	.45
7406	.19	74125	.49
7408	.19	74154	1.19
7410	.19	74175	.79
7438	.22	74367	.59

74 LS

LS00	.24	LS123	.99	LS221	1.10
LS04	.24	LS125	.95	LS240	.99
LS05	.24	LS138	.79	LS241	.99
LS10	.24	LS139	.79	LS244	.99
LS14	.89	Ls151	.79	LS245	1.95
LS20	.24	LS153	.79	LS266	.59
LS27	.24	LS154	1.75	LS283	.99
LS30	.24	LS157	.79	LS293	1.75
LS32	.36	LS161	.99	LS367	.79
LS74	.44	LS164	.99	LS368	.79
LS85	.95	LS175	.89	LS373	.99
LS86	.39	LS181	1.99	LS375	1.19
LS90	.69	LS193	.89	LS377	1.49
				LS393	1.50

VOLTAGE REGULATORS

7805	.99	7905	.99
7812	.99	7912	.99
7815	.99	7915	.99
7824	.99	7924	.99

*LM323K-5v-3amp To-$3.95 3/10.00

74-S

74S04 .... $ .39
74S138 .... .95
74S240 .... 1.99
74S244 .... 1.99

4116-300n.s. ..... 8/12.95 2732A-3-4K x 8 350n.s. Intel Pin Out Low Power 17.50

NEXT MONTH — The most exciting item we have ever seen — MOHO

DIGITAL RESEARCH: PARTS

"TOP QUALITY PARTS FOR LESS"

Precision Hybrid Oscillator Module

Has both 1 MHZ and 2 MHZ TTL - outputs — Hermetically sealed — Ultra high stability over wide temp. range — originally cost over $40.00 each — We made a super purchase from a major computer manufacturer — 5 Volt operation - fits standard 24 pin socket - Manufactered by Motorola oscillator division.

MC6871A

3/20.00

7.50 w/data

NEO 2137 by NEC

- Microwave R.F. transistor (N.P.N.)
- Micromold package #37
- Dual Emitter leads
- FT to 4.5 GHZ
- VCEO 10V-CC 20 MA. HFE 40-200
- Gain 10V-20MA-1GHZ = 14DB Typical
- Very low noise - High gain 1.5 DB @ 500 MHZ
- Cleared for high reliability space applications

COMPARE 1.50

LM117

An easy to use adjustable Voltage Regulator - only two external resistors needed to set the output voltage - TO-3 Case - adjustable from 1.2 to 37V - Regulator is floating, so it can be used in a wide variety of applications, as long as the input-to-output differential voltage is 40V or less - 1.5A output current - house numbered - prime - Motorola.

1.75

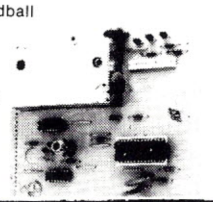
Video Game Board

Hockey • Tennis • Handball

- General Instruments AY3-8500
- Features Exciting Sounds
- On Screen Scoring
- 1 or 2 Players
- Speed & Paddle Controls
- Works on 9 Volts D.C.

4.45
3 for 12.00

Each board comes with RF Modulator (Ch. 3 or 4) and schematic. The only parts needed to complete game are speaker, 2-1 Meg Pots & Switches.



Video Paddle Controls

2 for 1.00

Can be used with game board at left.

SEE WHAT BILLY BOB HAS TO SAY ON PAGE 18 OF OUR NEW CATALOG!

TERMS:
Add $1 postage, we pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa, MasterCard and American Express cards. Tex. Res. add 5% Tax. Foreign orders (Canada 10%) add 20% P & H.

• VISA • MASTERCARD • AMERICAN EXPRESS •

Digital Research: Parts

P.O. Box 401247B • Garland, Texas 75040
(214) 271-2461

✓See List of Advertisers on page 210

7400

SN7400N	.20	SN7472N	.29	SN74156N	.79
SN7401N	.20	SN7473N	.35	SN74157N	.69
SN7402N	.25	SN7474N	.35	SN74160N	.89
SN7403N	.25	SN7475N	.49	SN74161N	.89
SN7404N	.25	SN7476N	.35	SN74162N	.89
SN7405N	.29	SN7479N	5.00	SN74163N	.89
SN7406N	.35	SN7480N	.50	SN74164N	.89
SN7407N	.35	SN7482N	.99	SN74165N	.89
SN7408N	.29	SN7483N	.69	SN74166N	1.25
SN7409N	.29	SN7485N	.89	SN74167N	2.79
SN7410N	.25	SN7486N	.35	SN74170N	1.95
SN7411N	.29	SN7489N	1.75	SN74172N	4.95
SN7412N	.35	SN7490N	.49	SN74173N	1.39
SN7413N	.40	SN7491N	.59	SN74174N	.99
SN7414N	.69	SN7492N	.45	SN74175N	.89
SN7416N	.29	SN7493N	.45	SN74176N	.79
SN7417N	.29	SN7494N	.69	SN74177N	.79
SN7420N	.25	SN7495N	.69	SN74179N	1.49
SN7421N	.29	SN7496N	.69	SN74180N	.79
SN7422N	.45	SN7497N	3.00	SN74181N	2.25
SN7423N	.29	SN74100N	1.49	SN74182N	.79
SN7425N	.29	SN74104N	.89	SN74184N	2.49
SN7426N	.29	SN74105N	.89	SN74185N	2.49
SN7427N	.25	SN74107N	.35	SN74190N	1.25
SN7428N	.49	SN74109N	.39	SN74191N	1.25
SN7430N	.25	SN74116N	1.95	SN74192N	.89
SN7432N	.29	SN74121N	.39	SN74193N	.89
SN7437N	.25	SN74122N	.55	SN74194N	.89
SN7438N	.40	SN74123N	.59	SN74195N	.69
SN7439N	.25	SN74125N	.49	SN74196N	.89
SN7440N	.20	SN74126N	.49	SN74197N	.89
SN7441N	.89	SN74132N	.75	SN74198N	1.49
SN7442N	.59	SN74136N	.75	SN74199N	1.49
SN7443N	1.10	SN74141N	.99	SN74221N	1.25
SN7444N	1.10	SN74142N	3.25	SN74251N	.99
SN7445N	.89	SN74143N	3.49	SN74276N	1.95
SN7446N	.79	SN74144N	3.49	SN74279N	.79
SN7447N	.69	SN74145N	.79	SN74283N	1.49
SN7448N	.79	SN74147N	1.95	SN74284N	3.95
SN7450N	.20	SN74148N	1.29	SN74285N	3.95
SN7451N	.20	SN74150N	1.25	SN74365N	.69
SN7453N	.20	SN74151N	.69	SN74366N	.69
SN7454N	.20	SN74152N	.69	SN74367N	.69
SN7459A	.25	SN74153N	.79	SN74368N	.69
SN7460N	.20	SN74154N	1.25	SN74390N	1.49
SN7470N	.29	SN74155N	.79	SN74393N	1.49

74LS

74LS00	.29	74LS92	.75	74LS192	1.15
74LS01	.29	74LS93	.75	74LS193	1.15
74LS02	.29	74LS95	.99	74LS194	1.15
74LS03	.29	74LS96	1.15	74LS195	1.15
74LS04	.35	74LS107	.45	74LS197	1.19
74LS05	.35	74LS109	.45	74LS221	1.19
74LS08	.35	74LS112	.49	74LS240	1.49
74LS09	.35	74LS113	.49	74LS241	1.49
74LS10	.35	74LS114	.49	74LS242	1.49
74LS11	.39	74LS122	.89	74LS243	1.49
74LS12	.35	74LS123	1.25	74LS244	1.49
74LS13	.59	74LS125	.59	74LS245	2.95
74LS14	.99	74LS126	.59	74LS247	1.19
74LS15	.35	74LS132	.99	74LS248	1.19
74LS20	.35	74LS133	.89	74LS249	1.19
74LS21	.35	74LS138	.89	74LS251	.99
74LS22	.35	74LS139	.89	74LS253	.99
74LS26	.35	74LS151	.89	74LS257	.89
74LS27	.35	74LS153	.89	74LS258	.89
74LS28	.35	74LS154	1.75	74LS260	.69
74LS30	.35	74LS155	.89	74LS266	.69
74LS32	.35	74LS156	.89	74LS273	1.95
74LS33	.59	74LS157	.89	74LS279	.89
74LS37	.45	74LS158	.89	74LS283	.89
74LS38	.39	74LS160	1.15	74LS290	.99
74LS40	.35	74LS161	1.15	74LS293	.99
74LS42	.89	74LS162	1.15	74LS298	1.25
74LS47	.89	74LS163	1.15	74LS352	1.29
74LS48	1.15	74LS164	1.15	74LS353	1.29
74LS49	1.15	74LS165	1.15	74LS365	.69
74LS51	.35	74LS168	1.19	74LS366	.69
74LS54	.35	74LS169	1.19	74LS367	.69
74LS55	.35	74LS170	1.95	74LS368	.69
74LS73	.45	74LS173	.99	74LS373	1.95
74LS74	.45	74LS174	.99	74LS374	1.95
74LS75	.59	74LS175	.99	74LS375	1.95
74LS76	.45	74LS181	2.95	74LS386	.89
74LS78	.49	74LS190	1.25	74LS393	2.49
74LS83	.89	74LS191	1.25	74LS399	2.49
74LS85	1.25			74LS670	2.49
74LS86	.49			81LS95	1.95
74LS90	.69			81LS97	1.95

74S

74S00	.45	74S124	3.95	74S243	3.25
74S02	.45	74S133	.55	74S244	3.25
74S03	.45	74S134	.69	74S251	1.45
74S04	.55	74S135	1.19	74S253	1.45
74S05	.55	74S136	1.75	74S257	1.35
74S08	.50	74S138	1.35	74S258	1.35
74S09	.50	74S139	1.35	74S260	.79
74S10	.45	74S140	.79	74S280	2.95
74S11	.45	74S151	1.35	74S287	3.25
74S15	.45	74S153	1.35	74S288	2.75
74S20	.45	74S157	1.35	74S373	3.49
74S22	.45	74S158	1.35	74S374	3.49
74S30	.45	74S160	2.95	74S387	2.95
74S32	.55	74S174	1.59	74S471	10.95
74S38	1.25	74S175	1.59	74S472	10.95
74S40	.50	74S188	2.95	74S473	10.95
74S51	.45	74S194	1.95	74S474	12.95
74S64	.50	74S195	1.95	74S475	12.95
74S65	.50	74S196	1.95	74S570	5.95
74S74	.75	74S240	2.95	74S571	5.95
74S86	.79	74S241	2.95	74S572	9.95
74S112	.79	74S242	3.25	74S573	9.95
74S113	.79			74S940	3.15
74S114	.79			74S941	3.15

CA—LINEAR

CA3010H	.99	CA3060N	3.25	CA3089N	3.75
CA3013H	2.15	CA3080H	1.25	CA3096N	3.95
CA3023H	3.25	CA3081N	2.00	CA3130H	1.39
CA3035H	2.49	CA3082N	2.00	CA3140H	1.25
CA3039H	1.35	CA3083N	1.60	CA3160H	1.25
CA3046N	1.30	CA3086N	.85	CA3401N	.59
CA3059N	3.25			CA3600N	3.50

CD—CMOS

CD4000	.39	CD4041	1.49	CD4098	2.49
CD4001	.39	CD4042	.99	CD4506	.75
CD4002	.39	CD4043	.89	CD4507	.99
CD4006	1.19	CD4044	.89	CD4508	3.95
CD4007	.25	CD4046	1.79	CD4510	1.39
CD4009	.49	CD4047	2.50	CD4511	1.29
CD4010	.49	CD4048	1.35	CD4512	1.49
CD4011	.39	CD4049	.49	CD4514	3.95
CD4012	.25	CD4050	.69	CD4515	2.95
CD4013	.49	CD4051	1.19	CD4516	1.49
CD4014	1.39	CD4052	1.19	CD4518	1.79
CD4015	1.19	CD4053	1.19	CD4519	.89
CD4016	.59	CD4056	2.95	CD4520	1.29
CD4017	1.19	CD4059	9.95	CD4526	1.79
CD4018	.99	CD4060	1.49	CD4528	1.19
CD4019	.49	CD4066	.79	CD4529	1.95
CD4020	1.19	CD4068	.39	CD4543	2.79
CD4021	1.39	CD4069	.45	CD4562	11.95
CD4022	1.19	CD4070	.55	CD4566	2.79
CD4023	.29	CD4071	.49	CD4583	2.49
CD4024	.79	CD4072	.49	CD4584	.75
CD4025	.23	CD4073	.39	CD4723	1.95
CD4026	2.95	CD4075	.39	CD4724	1.95
CD4027	.69	CD4076	1.39	MC14409	17.95
CD4028	.89	CD4078	.55	MC14410	18.95
CD4029	1.49	CD4081	.39	MC14411	15.95
CD4030	.49	CD4082	.39	MC14412	15.95
CD4034	3.49	CD4093	.99	MC14419	7.95
CD4035	.99			MC14433	15.95
CD4040	1.49			MC14538	2.49
				MC14541	1.95

Phone Tunes

As Seen on "Good Morning America"

Replaces the Telephone Ringer Bell with a Selection of 30 Familiar Tunes

Each Unit will play any of the following tunes:

- Rule Brittania
- O Canada
- Colonel Bogey
- Westminister Chimes
- Mexican Hat Dance
- Twinkle, Twinkle Little Star
- Deutschlandlied
- God Save the Queen
- Close Encounters
- Happy Birthday
- Wedding March
- Jingle Bells
- Auld Lang Syne
- Soldiers Chorus
- Sailor's Hornpipe
- Charge!
- Greensleeves
- Lorelei
- Eyes of Texas
- Star Spangled Banner
- Oranges and Lemons
- Wilhelmus
- Mozart Sonata
- Pomp & Circumstance
- William Tell Overture
- Bach Toccata in D Minor
- Shave and a Haircut
- Blue Danube Waltz
- Beethoven's 5th
- La Marseillaise

FEATURES

Replaces monotonous telephone ringer bell. Easily connects to any standard telephone. Can be used alongside regular phone or replace a remote ringer elsewhere in building or outside. FCC approved. Can be used on any telephone system — worldwide. Use a different tune to identify extension phones. Microprocessor controlled. Adjustable volume control and variable tune speed control. Operates on two 9-volt batteries or AC Adapter (not included).

PT030 Phone Tunes $49.95
AD30 AC Adapter $8.95

DISCRETE LEDS

XC556R	.200"	red	5/$1	MV50	.085"	red	6/$1
XC556G	.200"	green	4/$1	XC209R	.125"	red	5/$1
XC556Y	.200"	yellow	4/$1	XC209G	.125"	green	4/$1
XC556C	.200"	clear	4/$1	XC209Y	.125"	yellow	4/$1
XC22R	.200"	red	5/$1	XC526R	.185"	red	5/$1
XC22G	.200"	green	4/$1	XC526G	.185"	green	4/$1
XC22Y	.200"	yellow	4/$1	XC526Y	.185"	yellow	4/$1
MV10B	.170"	red	4/$1	XC526C	.185"	clear	4/$1

.200(T1¾) Red/Green

Diffused Bi-Color LED

Part No.	1-99	100+
XC5491	.79	.69

XC556 RED LED, METAL MTG. HDW. 2-6" LEADS.

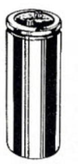
RL-2 . . $.39 ea. or 3/$1.00

DISPLAY LEDS

C.A. — Common Anode
D.D. — Double Digit
C.C. — Common Cathode
RHD — Right Hand Decimal

Type	Polarity	Ht	Price	Type	Polarity	Ht	Price
MAN 1	C.A.—red	.270	2.95	DLG507	C.A.—green	.500	1.25
MAN 2	5x7 D.M.—red	.300	4.95	DL704	C.C.—red	.300	1.25
MAN 3	C.C.—red	.125	.25	DL707	C.A.—red	.300	1.25
MAN 52	C.A.—green	.300	.99	DL728	C.C.—red	.500	1.49
MAN 54	C.C.—green	.300	.99	DL741	C.A.—red	.600	1.25
MAN 71	C.A.—red	.300	.75	DL747	C.A.—red	.600	1.49
MAN 72	C.A.—red	.300	.75	DL750	C.C.—red	.600	1.49
MAN 74	C.C.—red	.300	1.25	DLO847	C.A.—orange	.800	1.49
MAN 82	C.A.—yellow	.300	.49	DLO850	C.C.—orange	.800	1.49
MAN 84	C.C.—yellow	.300	.99	DL338	C.C.—red	.110	.35
MAN 3620	C.A.—orange	.300	.49	FND358	C.C. ± 1	.357	.99
MAN 3630	C.A.—orange ± 1	.300	.99	FND357	C.C.	.357	.75
MAN 3640	C.C.—orange	.300	.99	FND500	C.C. (FND503)	.500	.99
MAN 4610	C.A.—orange	.400	.99	FND507	C.A. (FND510)	.500	.99
MAN 6610	C.A.—orange—DD	.560	.99	HDSP-3401	C.A.—red	.800	1.50
MAN 6630	C.A.—orange ± 1	.560	.99	HDSP-3403	C.C.—red	.800	1.50
MAN 6640	C.C.—orange—DD	.560	.99	HDSP-3406	C.C. red ±1	.800	1.50
MAN 6650	C.C.—orange ± 1	.560	.99	5082-7751	C.A., R.H.D.—red	.430	1.25
MAN 6660	C.A.—orange	.560	.99	5082-7760	C.C., R.H.D.—red	.430	1.25
MAN 6710	C.A.—red—DD	.560	.99	5082-7300	4x7 Numeric (RHD)	.600	22.00
MAN 6740	C.C.—red—DD	.560	.99	5082-7302	4x7 Numeric (LHD)	.600	22.00
MAN 6750	C.C.—red ± 1	.560	.99	5082-7340	4x7 Hxdcl. (0-9/A-F)	.600	22.50
DLO304	C.C.—orange	.300	1.25	4N28	Photo Xsistor Opto-Isol.		.69
DLO307	C.A.—orange	.300	1.25	LIT-1	Photo Xsistor Opto-Isol.		.69
DLG500	C.C.—green	.500	1.25	MOC3010	Optically Isol. Triac Driver		1.25

COMPUTER GRADE CAPACITORS



MFD	WVDC	PRICE	MFD	WVDC	PRICE	MFD	WVDC	PRICE
250	150	1.95	10,000	15	2.95	24,000	20	2.95
500	200	2.49	10,000	16	3.95	27,000	10	2.95
1,250	3	.99	11,000	19	4.95	32,500	25	4.95
1,500	25	1.95	11,000	55	5.49	40,000	25	5.95
1,500	50	2.95	11,000	60	5.95	43,000	10	5.95
2,000	10	2.95	13,000	16	2.95	50,000	20	7.95
2,250	100	3.95	14,000	13	2.95	52,000	20	5.95
2,300	33	2.95	14,000	35	3.95	55,000	15	5.95
2,500	15	2.95	18,000	10	3.95	58,000	20	5.95
3,000	25	1.95	20,000	20	2.95	65,000	10	7.95
3,600	40	3.95	20,000	55	3.95	73,800	5	7.95
4,500	50	3.95	21,000	15	3.95	80,000	15	9.95
5,500	25	4.49	23,000	7	1.95	90,000	10	8.95
6,100	40	2.49	23,000	10	2.95	160,000	10	8.95
6,600	50	4.95	23,000	20	3.95			

OVER 200 OTHER VALUES AVAILABLE — CALL OR WRITE FOR YOUR REQUIREMENT

LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS — 5%

ASST. 1	5 ea.	10 Ohm 12 Ohm 15 Ohm 18 Ohm 22 Ohm / 27 Ohm 33 Ohm 39 Ohm 47 Ohm 56 Ohm	50 pcs.	$1.95
ASST. 2	5 ea.	68 Ohm 82 Ohm 100 Ohm 120 Ohm 150 Ohm / 180 Ohm 220 Ohm 270 Ohm 330 Ohm 390 Ohm	50 pcs.	$1.95
ASST. 3	5 ea.	470 Ohm 560 Ohm 680 Ohm 820 Ohm 1K / 1.2K 1.5K 1.8K 2.2K 2.7K	50 pcs.	$1.95
ASST. 4	5 ea.	3.3K 3.9K 4.7K 5.6K 6.8K / 8.2K 10K 12K 15K 18K	50 pcs.	$1.95
ASST. 5	5 ea.	22K 27K 33K 39K 47K / 56K 68K 82K 100K 120K	50 pcs.	$1.95
ASST. 6	5 ea.	150K 180K 220K 270K 330K / 390K 470K 560K 680K 820K	50 pcs.	$1.95
ASST. 7	5 ea.	1M 1.2M 1.5M 1.8M 2.2M / 2.7M 3.3M 3.9M 4.7M 5.6M	50 pcs.	$1.95
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)		$10.95 ea.

$10.00 Min. Order — U.S. Funds Only
Calif. Residents Add 6% Sales Tax
Postage—Add 5% plus $1.50 Insurance

✓41

Spec Sheets — 25¢
Send 86¢ Postage for your
FREE 1982 JAMECO CATALOG

NEW 1982 CATALOG

Jameco ELECTRONICS

PHONE ORDERS WELCOME (415) 592-8097

MAIL ORDER ELECTRONICS — WORLDWIDE

1355 SHOREWAY ROAD, BELMONT, CA 94002

12/81 PRICES SUBJECT TO CHANGE

INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	24.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	29.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.95
8212CPA	Volt Ref/Indicator	2.95

74C

74C00	.39	74C95	1.59	74C221	1.95
74C02	.39	74C107	1.89	74C240	2.25
74C04	.39	74C151	2.95	74C244	2.25
74C08	.39	74C154	3.95	74C373	2.49
74C10	.39	74C157	2.25	74C374	2.59
74C14	.75	74C160	1.69	74C901	.69
74C20	.39	74C161	1.60	74C903	.69
74C30	.39	74C162	1.49	74C911	10.95
74C42	1.39	74C163	1.69	74C912	10.95
74C48	1.95	74C164	1.59	74C915	1.69
74C73	.79	74C173	1.39	74C917	10.95
74C74	.79	74C174	1.39	74C922	5.49
74C85	1.95	74C175	1.19	74C923	5.75
74C86	.99	74C192	1.69	74C925	7.50
74C89	6.95	74C193	1.69	74C926	7.50
74C90	1.29	74C195	1.59	80C95	.79
74C93	1.29			80C97	.79

LINEAR

LH0002CN	6.85	LM340T-5	1.25	LM702H	.79
LM10CLH	4.50	LM340T-12	1.25	LM703CN	.89
LM11CLH	4.75	LM340T-15	1.25	LM709N	.29
LH0070-OH	4.95	LM341P-5	.75	LM710N	.79
TL071CP	.79	LM341P-12	.75	LM711N	.79
TL072CP	1.39	LM341P-15	.75	LM723N	.69
TL074CN	2.49	LM342P-5	.69	LM733N	1.00
LH0082CD	35.80	LM342P-12	.69	LM739N	1.19
TL082CP	1.19	LM342P-15	.69	LM741CN	.35
TL084CN	2.19	LM348N	1.25	MC1741SCG	3.00
LH0094CD	36.80	LM350K	5.75	LM747N	.79
LM300H	.99	LF351N	.60	LM748N	.59
LM301CN	.35	LF353N	1.00	LM1014N	2.75
LM302H	1.95	LF355N	1.10	LM1310N	1.95
LM304H	1.95	LF356N	1.10	MC1458CN	.59
LM305H	.99	LM358N	1.00	LM1488N	1.25
LM307CN	.45	LM359N	1.79	LM1489N	1.25
LM308CN	1.00	LM370N	4.49	LM1496N	1.95
LM309H	1.95	LM373N	3.25	LM1556V	1.75
LM309K	1.25	LM377N	2.95	LM1800N	2.95
LM310CN	1.75	LM380N	1.25	LM1871N	5.49
LM311/CN	.90	LM381N	1.95	LM1872N	5.49
LM312H	2.49	LM382N	1.79	LM1877N-9	3.25
LM317MP	1.15	LM384N	1.95	LM1889N	3.20
LM317T	1.75	LM386N-3	1.29	LM1896N	1.75
LM317K	3.95	LM387N	1.45	LM2002T	1.49
LM318CN	1.95	LM389N	1.35	LM2877P	2.05
LM319N	1.25	LM392N	.69	LM2878P	2.25
LM320K-5	1.35	LF398N	4.00	LM2896P-1	2.25
LM320K-12	1.35	LM399H	5.00	LM3189N	2.95
LM320K-15	1.35	TL494CN	4.49	LM3900N	.69
LM320T-5	1.25	TL496CP	1.75	LM3905CN	1.25
LM320T-12	1.25	NE510A	6.00	LM3909N	1.15
LM320T-15	1.25	NE529A	4.95	LM3914N	3.95
LM323K	5.95	NE531H	3.95	LM3915N	3.95
LM324N	.99	NE536H	6.00	LM3916N	3.95
LM329DZ	.65	NE540H	6.00	RC4136N	1.25
LM331N	3.95	NE544N	4.95	RC4151NB	3.95
LM334Z	1.30	NE550A	1.30	RC4194TK	6.95
LM335Z	1.40	NE555V	.39	RC4195TK	5.49
LM336Z	1.75	NE556N	.99	LM4500A	3.25
LM337T	1.95	NE564N	3.95	ICL8038B	4.95
LM337MP	1.15	LM565N	1.25	LM13080N	1.29
LM338K	6.95	LM566CN	1.95	LM13600N	1.49
LM339N	.99	LM567V	1.25	75138N	1.95
LM340K-5	1.35	NE570N	4.95	75450N	.89
LM340K-12	1.35			75451CN	.39
LM340K-15	1.35			75492	.89

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

Value	1-9	10-99	100+	Value	1-9	10-99	100+
10 pf	.08	.06	.05	.001µF	.08	.06	.05
22 pf	.08	.06	.05	.0047µF	.08	.06	.05
47 pf	.08	.06	.05	.01µF	.08	.06	.05
100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
,01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (Solid) CAPACITORS

.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/35V	.51	.45	.34
.22/35V	.39	.34	.29	3.3/25V	.53	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.55
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/6V	.79	.69	.55

MINI. ALUMINUM ELECTROLYTIC CAPACITORS

Axial	1-99	100-499	500+	Radial	1-99	100-499	500+
.47/50V	.16	.14	.10	.47/25V	.15	.13	.12
1.0/50V	.19	.16	.12	.47/50V	.16	.14	.13
3.3/50V	.17	.15	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/25V	.16	.14	.13
10/25V	.18	.15	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.54	.49	.45	100/50V	.37	.34	.31
1000/16V	.79	.69	.61	220/16V	.25	.21	.19
2200/16V	.89	.79	.69	470/25V	.35	.31	.27

✓See List of Advertisers on page 210

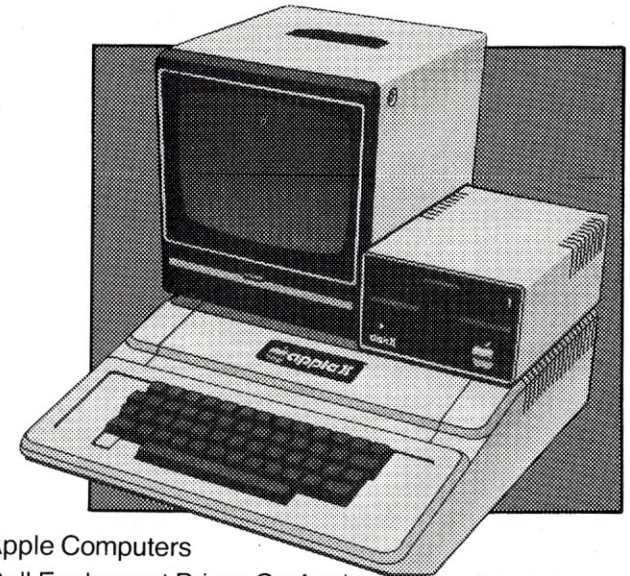
ELECTRONICS CENTER

CALL TOLL FREE ✓25

1-800-228-4097

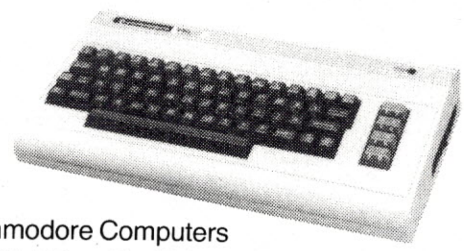
Commodore Computers

CALL FOR LOWEST PRICES

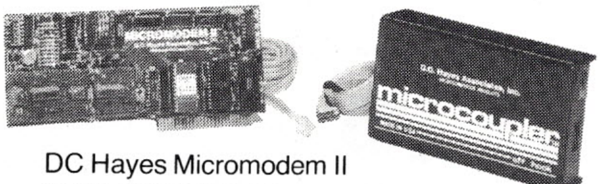


Apple Computers
Call For Lowest Prices On Apple

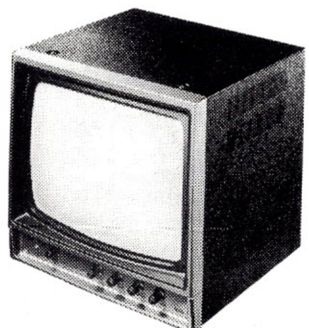
EPSON Printers
CALL FOR PRICE



Commodore Computers
Call Toll Free For Price



DC Hayes Micromodem II
CALL FOR PRICES



NEC Monitors

9" NEC Monitor	$139.95
12" NEC Monitor	$179.95
12" Green Screen	CALL
13" NEC Color Monitor With Tuner	$499.95
19" NEC Color Monitor	$499.95

ATARI
A Warner Communications Company

Atari Computers • Our Atari Prices Can't Be Beat!

PRICES SUBJECT TO CHANGE AND AVAILABILITY

WE TRADE — WE EXPORT

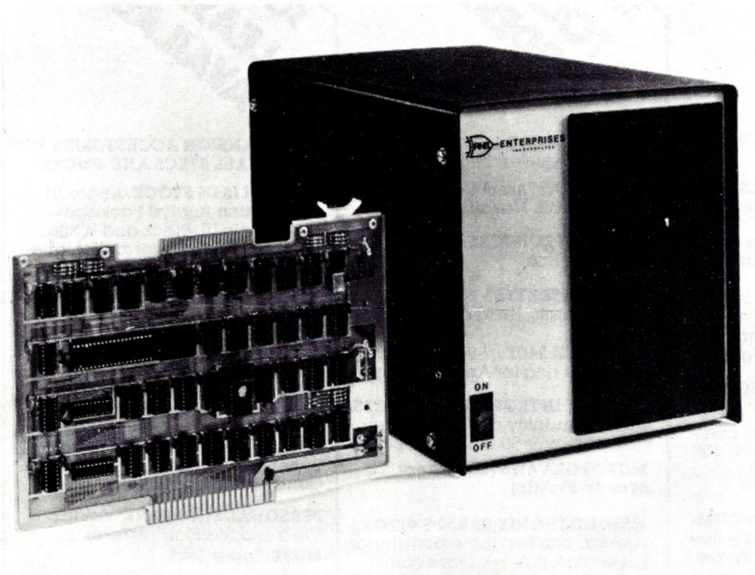
YOUR ELECTRONICS PLAYGROUND

1840 "O" Street Lincoln, Nebraska 68508
In Nebraska Call (402) 476-7331

master charge THE INTERBANK CARD

VISA

VAK-7 8″ FLOPPY DISK SYSTEM
FOR AIM-65, SYM-1



The VAK-7 Disk System was specifically designed for use with AIM-65 and SYM-1 Microcomputer Systems. The VAK-7 is a complete full size (8″) Floppy Disk System. This system will Read, Write and Format IBM Single and Dual Density diskettes. The VAK-7 is available with both Single and Dual Sided Disk Drives. Each Disk Drive comes with its own cabinet and Power Supply. The VAK-7 can handle up to 4 disk drives, totaling more than 4.98 Megabytes of storage.

The VAK-7 Disk System incorporates both advanced hardware and innovative software designs. The addition of the VAK-7 produces a very powerful and useful computer system. Unlike most other disk systems, there is no requirement for the user to provide RAM to hold the Disk Operating System software. No valuable time is wasted loading in the DOS from cassette tape, because the VAK-7 DOS software is in onboard ROM. The VAK-7 is located above the 32K boundary (8000 HEX), leaving the user with a full 32K bytes of contiguous address space for his own use.

AIM-65—Allows the user to save and load object code thru the AIM Monitor; to load, save, and append Text thru the AIM Editor; to load, save, and append Basic Programs thru the BASIC INTERPRETER; to assemble directly from disk single or multiple file programs.

SYM-1—Allows the user to save and load Files for use with the SYM Monitor, SYM Basic, and RAE-1.

ADDITIONAL COMMANDS:

ACTIVATE A DELETED FILE	FORMAT A DISK
COMPRESS A DISK	DELETE A DISK FILE
RENAME A DISK FILE	INITIALIZE A DISK
COPY A DISK	LIST CATALOG

SPECIFICATIONS:

- Completely assembled, tested, and burned in.
- Occupies address 8000-8FFF for AIM-65, $9000-9FFF for SYM-1, or $E000-EFFF for KIM-1.
- IBM Format; Single Density (128 bytes/sector); Dual Density (256,512, or 1024 bytes/sector).
- All ICs are in sockets.
- Fully buffered address and data bus.
- Standard KIM-4* BUS (both electrical pin-out and card size).
- Designed for use with a regulated power supply, but has provisions for adding regulators for use with an unregulated power supply.
- Dimensions: Board—10″ wide x 7″ high (including card-edge). Cabinet—9.25″ wide x 10″ high x 16″ deep.
- Power Requirements: +5v DC @ 2 Amps.
  117 AC 60Hz @ 2 Amps.
- Shipping Weight: 25 lbs.

**KIM-4 is a product of MOS Technology/C.B.M.*

PRICING:

VAK-7 **$1,299.00**
Controller and One Single-Sided Drive

VAK-7A **$599.00**
Additional Single-Sided Drive with Cabinet and Power Supply

VAK-7B **$1,599.00**
Controller and One Dual-Sided Drive

VAK-7C **$899.00**
Additional Dual-Sided Drive with Cabinet and Power Supply

CALL OR WRITE FOR FREIGHT CHARGES

RNB ENTERPRISES INCORPORATED ✓52

4030 N. 27th Avenue, Suite D
Phoenix, AZ 85017
(602) 265-7564

master charge VISA

✓See List of Advertisers on page 210

SYSTEMS APPLE II STARTER

$1895

SAVE OVER $200 ON OUR BEST SELLING APPLE SYSTEM/ System includes a 48K Apple II, Apple Disk, DOS 3.3 and Controller and a Sup R MOD RF Modulator.
List $2209.

EXCLUSIVE FOR THE APPLE: Magic Wand, Videx, Z-80 softcard (Requires 48K Apple and disk).

COMPLETE SUB-SYSTEM $925.

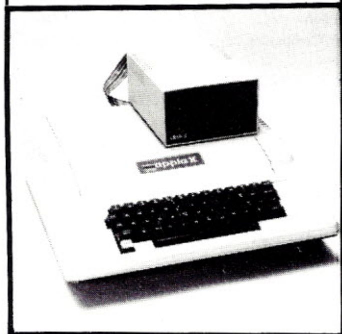
APPLE ACCESSORIES

CHOOSE FROM: Silentype Printer w/x face/Light Pen/Easy Writer (80 col. need a Videx)/Clock for Apple.

FROM MICROSOFT: 16K RAM Board/FORTRAN.

FROM COMPUTER STATION: Hi-Res Dump for 460 Printer.

OUR APPLE INVENTORY IS COMPLETE. WE'VE GOT IT ALL—



apple computer
Authorized Dealer
Accept No Less

SYSTEMS XEROX 820

WE HAVE IT!

$5699

At last a CPM based system that looks like it belongs in your office. The 820 can be ordered with 51/4" or 8" drive and a family of printers from NEC SPINWRITERS, for letter quality, to the many currently available dot matrix serial printers.

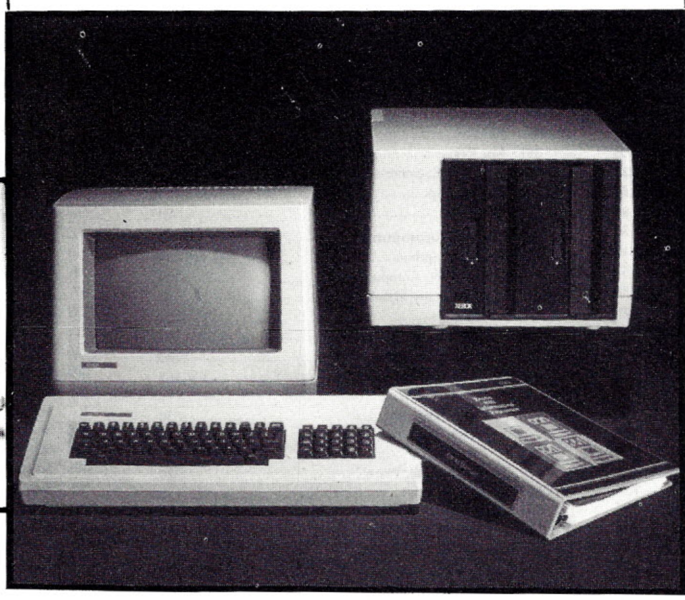
We recommend this system to our professional/business customers.

A GREAT PRICE FOR A LOT OF MACHINE. SPECS: SCREEN 24 LINES x 80 CHARACTERS. DISK 51/4 DUAL OR 8" DUAL. KEYBOARD TYPEWRITER STYLE WITH 20 KEY PADS. PORTS INCLUDE SERIAL AND PARALLEL (1 EACH).

SPECIAL INTRODUCTORY SYSTEM PRICE **SAVE $1000.**

820 SYSTEM I (51/4" DUAL) W/ SPINWRITER CPM AND WORDSTAR—$5699.

820 SYSTEM II (8" DUAL) W/ SPINWRITER CPM AND WORDSTAR—$6699.



SYSTEMS AIM 65 STARTER

$795

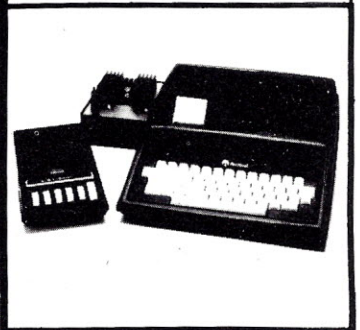
FROM ROCKWELL

THE SMALL SYSTEM FOR CHRISTMAS BUYING

Our **AIM** Starter System for Educational & Laboratory use includes **4K AIM/BASIC & ROM/ASSEMBLER & ROM/POWER SUPPLY EG1 ENCLOSURE/CRAIG TAPE RECORDER.**

ACCESSORIES FOR AIM STARTER: PL 65 High Level Language/Paper for the Aim (roll)/Rockwell's 4 slot Motherboard/

WE ALSO CARRY RM EXPANSION ACCESSORIES FOR THE AIM-65.



Rockwell International
Authorized Dealer
Accept No Less

800-343-5504

IN MASS CALL 617-491-2700

Systems Customized

COMPUMART

43

65 Bent Street, Dept 122
PO Box 568, Cambridge, MA 02139

VISA

MasterCard

From THE LEADER...

We just might be the largest independent small systems dealer in the country. Here's why:

COMPUMART has been serving the computer needs of industry since 1971.

We stock, for immediate shipment, only those products from the finest micro-computer manufacturers.

And any product, except software, can be returned within 10 days for a full refund—even if you just change your mind. We also honor all manufacturers' warranties. Our expert technicians will service any product we sell

Call us for more information on products, product configuration and service. Our phones are open Monday thru Friday, 8:30 a.m. to 7:00 p.m. and Saturday 11:00 a.m. to 4:00 p.m.

We have a staff of highly knowledgeable sales people waiting to hear from you, and to help. Because service is what we're all about.

ORDER EARLY FOR CHRISTMAS DELIVERY • CALL EARLY FOR GUARANTEED DELIVERY DATES

kilobaud Peterborough NH 03458

MICROCOMPUTING T.M. LIST OF ADVERTISERS

For further information from our advertisers, please use the Reader Service card.

*This advertiser prefers to be contacted directly.

LETTERS

(from page 30)

cut out a lot of unnecessary searching and time. For example, I was able to reduce one benchmark program's overall processing time from 10 minutes down to five. Not bad!

The second improvement was to merge the Spooling program with the main FILEMAP program (presuming you can afford the memory space). I simply added it on the end of the program and added a GOTO1300 at the end of line 820. Also, I altered the original Spool program to give me the option of displaying it out on the CRT or printer (see attached lines 1300–1400).

Michael W. Tolmasoff
Healdsburg, CA

More on Software

This letter is written in response to a spate of complaints regarding the poor quality of software and the subject of software theft appearing in trade magazines. Since the shortage of good software is generally that classed as applications software, my discussion is generally limited to that class. Some of these complaints are:

- A general belief that programs presently being distributed without source code are not usable, that they are either unsuitable in nature or full of errors.
- The software vendor has a "stranglehold" on the market, as one writer suggests. Hence, the pricing is unreasonable. Also a stated belief that if the price was "reasonable" the market base would be broadened, purportedly making it not profitable to copy.

There are problems in the securing of well-designed and executed software. There are about three ways to get good software.

- Contract with a programming house for your needs. This may be the only way on occasion, but it will not be cheap.
- Purchase a package with the source code included. Now, it is a fact that the better-designed a package is the more costly to produce, and the more carefully debugged and documented, the less likelihood that the software will be released at cassette-program prices. Do you *really* want to go through revision and retesting of package software? It takes a lot of accounting and programming and design background to execute a wall-to-wall accounting package. What makes you think you can do it? So far, few persons of any background have done so, though the magazines are full of hopefuls.
- Purchase a previously-tested set of programs with support from the vendor as to modifications needed. No software should be purchased without spending considerable time seeing it in operation. If you don't see it work, don't buy it. Study the manual, discuss the operations in detail with your CPA and your employees who will have to use the programs.

It is not likely that applications software (a typical program-set runs about 1000 pages of code) will ever be priced at $39.95. The mere writing of a carefully tailored program limits its use. Programs which purport to serve everybody serve no one well. The potential users will run only into the hundreds, not the hundreds-of-thousands that games and word-processing programs or utilities can expect. It also takes a long time to write. How does five or six man-years grab you?

The present market and unusable copyright or patent laws do not protect the developer but in fact encourage theft. There are not many good applications out there. Do you really think that wholesale theft will reduce the price to the user? The thief intends to market the loot for all he can get. He is not a Robin Hood.

★ SOFTWARE ★ HARDWARE ★ SUPPLIES ★ DISCOUNT PRICES

See List of Advertisers on page 210

Insofar as reducing the price to a point where it will be unprofitable to steal, forget it. A greedy person can never have enough of wealth, nor is there any level below which he will not stoop to steal.

Gorden R. Page
Turnkey Business Systems
Philadelphia, PA

North Star DOS Edit Change

When I finally sold my SOL-20 and the North Star disk system, I ordered a new Horizon and Soroc terminal. One of the things I noticed was that the arrows did not work when editing in BASIC as they did on the SOL-20. When I decided to try and change this, I went all the way and have most of the edit commands on a single key.

The program simply rewrites the port 0 input routine to check for the input of arrows or the escape key. (See Listing 2.) If these characters are input, they are changed to the proper control characters for editing.

I did this on LF DOS 8000H and I used the monitor to do the changes (starting at 8800 instead of 2900) then did an SF DOS 8000 and it all worked fine on my release S.O. version of DOS 5.2.

E.B. Robinson
Belleville, Ontario

```
2900   FE02     CP1  2      Check for dev. 2
2902   CA2229   JZ 2922     Jump if parallel port
2905   FE01                 Check for dev. 1
2907   CA1629   JZ 2916     Jump if second serial port
290A   C3BD29   JP 298D     Assume port o
                            New Port o Routine
29BD   DB03     IN   3      Input serial port status
29BF   E602     AN1 2       Mask input status bit
29C1   CAB029   JZ29BD      Jump if no character
29C4   DB 02    IN2         Get character
29C6   E67F     AN1 7F      Mask off parity bit
29C8   FE0C     CP1 0C      Check for right arrow
29CA   CA DD29  JZ 29DD     Jump to 29DD if right arrow
29CD   FE0A     CP1 0A      Check for up arrow
29CF   CAE029   JZ 29E0     Jump to 29E0 if up arrow
2902   FE0B     CP1 0B      Check for down arrow
29D4   CAE329   JZ29E3      Jump to 29E3 if down arrow
29D7   FE1B     CP1 1B      Check for "esc" Key
29D9   CAE629   JZ29E6      Jump to 29E6 if "esc"
29DC   C9       Ret         Return with character in A
29DD   3E01     Mov A 01    Move 01 into A
29DF   C9       Ret         Return
29E0   3E 19    Mov A 19    Move 19 into A
29E2   C9       Ret         Return
29E3   3E 1A    Mov A 1A    Move 1A into A
29E5   C9       Ret         Return
29E6   3E 07    Mov A 07    Move 07 into A
29E8   C9       Ret         Return
```

Listing 2.

Handy Hexpad

The following suggestion is for all two-finger typists like myself who find entering hex data with TBUG a pain.

This small modification to TBUG (only 15 bytes) should make life much simpler by converting the numeric keypad into a very handy hexpad. Using the right thumb on the shift key, it is easy to key in A to F with shift-1 to shift-6.

The following code changes are made to TBUG by itself:

```
45BB FA8149  JP M,4981H

4981 FE21    CP 21H      ;"!"
4983 FAA445  JP M,45A4H
4986 FE27    CP 27H      ;"!"
4988 F2A445  JP P,45A4H
498B D617    SUB A,17H
498D C9      RET
```

The code changes will cause a branch out of the keyboard scan routine at 45BBH when the ASCII value in register A is less than 30H (Ø). Two tests are then made to assure that the value in register A is in fact one of the six shifted values (21H to 26H). Subtracting 17H from (or adding E9H to) register A returns the desired values to the screen.

After the changes to TBUG have been made, you can save the modified version of TBUG by typing: P 4380 498D 4380 TBUG# (ENTER). This modification to TBUG has eased my code entry considerably, although now my right thumb is taking the beating that my index fingers once got!

John C. Klassen
Winnipeg, Manitoba

Sorcery with OSI

When I saw the article in the June 1981 issue of *Microcomputing*, "Teach a Sorcerer New Tricks" (p.76), I wondered if it could be adapted to OSI. It can and it works 100 times faster when renumbering one of my game programs which is over 5000 bytes long.

The changes for use with an OSI are: 6500 becomes 63000 (65000 doesn't work for some reason). ZB = 768 (not 468 —OSI program space starts at 0300 H).

The tokens are slightly different: GOTO = 136 (not 137).
RUN = 137.
GOSUB = 140 (not 141).
THEN = 160 (not 162).

I also added one line:

63197 IFCV = 137 ORCV = 160THEN63185.

One other small point. In the original program, if the line number increased from one or two digits to three or four, the ampersand (&) was printed. In the second program in the same situation, an error message is printed on the screen.

To correct this all you have to do when you are typing your program is put a number of spaces before the number so the spaces and number total four. For example

100 IF X THEN999
100 IF X THEN 999
(You don't need spaces in OSI Microsoft BASIC.)

This way when you renumber either up or down you do not have an error message, you have a correctly renumbered program.

Jim Verdon
Sarnia, Ontario

Lousy Software

Wayne Green's editorial in the September *Microcomputing* mentions the problem of lousy software. God

knows that there is an awful lot of it floating around this world. The primary aspect of the problem is not even programs containing actual bugs (these rarely get off the ground at all), but rather programs that are inefficient and/or poorly designed. In particular, the tendency of programmers to try to design and write everything absolutely from scratch, without regard to advances in the state of the art made by others, continues to result in unwieldy, restriction-filled programs even when techniques for eliminating these kinds of characteristics are well-established.

The kicker is that *Microcomputing* actually *contributes* to this problem due to the kinds of reviews that you choose to publish. I have never once encountered a single review in your magazine which effectively counseled the reader not to buy the program being reviewed, or that explicitly suggested that a competing program embodied a better approach to the task at hand.

Now, I understand that a magazine can get itself into trouble with its advertisers by bringing points like this to the attention of readers. In fact, this alone, I'm sure, accounts for your reluctance to do so. But, by the same token, it seems sort of pointless to take up space in your magazine printing reviews that the reader has to take with such a large grain of salt that he might as well not read them in the first place. Because many readers do not have the technical expertise necessary to sift the wheat from the chaff in dealers' demonstrations, one would hope that the whole point of a review is to provide the reader with an expert opinion on the pros *and cons* of a particular product.

Timothy Stryker
Pompano Beach, FL

It also seems sort of pointless to take up space in our magazine printing reviews of products that don't deserve to be in the marketplace in the first place. Why should you waste your time reading about them? We feel that any publicity—whether it is good or bad—given to a really rotten product is free publicity that the company doesn't deserve. Thus, we limit our coverage in the magazine's review sections to those products deserving of review, which our authors examine from both sides of the fence. And, it goes without saying that we do not limit our articles to those covering advertisers' products. We do not patronize our advertisers in our review section and do not bother reviewing products that we determine to be trash. Conclusion: Be very careful about buying products that have not been reviewed in Microcomputing.*—Editors.*

National Careers for the Disabled Symposium

The first National Careers for the Disabled Symposium will be sponsored by Commodore Business Machines, Inc., in association with Careers for the Disabled, Inc. The symposium will be held on Dec. 4–6, 1981, at the Convention Center in Baltimore, MD.

For additional information contact Careers for the Disabled, 261 Madison Ave., Suite 1102, New York, NY 10016.

Teleconferencing Technologies Seminar

The Teleconferencing Technologies Seminar will be held at the Hilton Harvest House, Boulder, CO, on Dec. 7 and 8, 1981. The seminar will focus on how to use teleconferencing to conduct business transactions and improve effectiveness and decision-making. Demonstrations of computer, video and audio teleconferencing will be conducted, offering hands-on experience.

The seminar is jointly sponsored by Cross Communications Co. and Colorado Video, Inc.

The cost of the seminar is $395, exclusive of meals and housing.

For further information contact Cross Communications Co., 934 Pearl, Boulder, CO 80302 (303-499-8888).

National Conference on Computer Graphics

The National Conference on Computer Graphics will be held Dec. 7–9 in Washington, D.C. The conference will spotlight trends in the application of computer graphics. Graphics equipment and demonstrations will be included.

Contact U.S. Professional Development Institute, 12611 Davan Dr., Silver Spring, MD 20904 (301-622-0066).

Second International Conference on Information Systems

The Second International Conference on Information Systems will be held in Boston, MA, Dec. 7–9.

For more information contact E.R. McLean, Graduate School of Management, University of California, Los Angeles, CA 90024 (213-825-2502).

Alpha Micro User's Society Convention

The second annual Alpha Micro User's Society convention will be held at the Deauville Hotel in Miami Beach, FL, the week of January 24–29, 1982. Demonstrations and workshops will be held on data communications, assembly language, structured programming and other subjects. Meetings will be held for institutions such as hospitals and schools, and special interest sessions will be held for the exchange of information about word processing, database management and business applications. Membership in the Alpha Micro User's Society is a prerequisite for attendance. Dues are $35, which includes a subscription to the monthly newsletter.

For further information, contact AMUS at 1911 11th St., Suite 210, Boulder, CO 80302 (303-449-6917).

Unix Tutorials

Three days of tutorials on the Unix computer operating system and the C programming language will be held January 11–13, 1982, in San Francisco, sponsored by Uni-Ops, a user's association.

Bulletins with full information on the tutorials are available from Uni-Ops, PO Box 5182, Walnut Creek, CA 94596 (415-933-8564).

First Annual Pacific Computer Exposition

The first annual Pacific Computer Exposition will be held at the San Diego Convention and Performing Arts Center, Jan. 21–23, 1982.

The computer show will feature software and hardware of interest to business, industry, education and homeowners. At least 200 exhibitors will participate in the exposition.

Detailed information for exhibitors is available by contacting Taylor R. Coleman at Judco Enterprises of Scottsdale, AZ (602-990-1751).

Consumer Electronics Show

The winter International Electronics Show will be held at the Las Vegas Convention Center Jan. 7–10.

For further information contact William T. Glasgow, Vice President, Consumer Electronics Shows, Two Illinois Center, Suite 1607, 233 North Michigan Ave., Chicago, IL 60601 (312-861-1040).

Micros in Education

Arizona State University is hosting the tenth annual Math/Science Conference on Jan. 15 and 16, 1982. The conference will focus on the microcomputer as a tool for instruction, as a research instrument and as an information manager.

For further information contact Nancy Watson, Conference Codirector, 203 Payne Hall, Arizona State University, Tempe, AZ 85287.

ACM Annual Computer Science Conference

The ACM Annual Computer Science Conference will be held Feb. 9–11, 1982, in Indianapolis, IN.

For more information contact Marshall Yovits, Indiana-Purdue University, 1125 E. 38 St., Indianapolis, IN 46205 (317-923-1321).

Interface Conferences

The Interface Group will hold the following major conferences and expositions for the computer industry: Federal DP Expo, Washington, DC, February 22–24; INTERFACE '82, Dallas, March 22–25; and COMDEX/SPRING, Atlantic City, June 28–30. For more information, contact The Interface Group, 160 Speen St., Framingham, MA 01701 (800-225-4620).

Texas Computer Show Postponed

James E. Myles, group show manager for Intercontinental Trade Shows Inc., has announced that the Texas Computer Show, scheduled to take place in the Dallas Convention Center from Jan. 20–22, 1982, has been postponed until March 9–11, 1983.

For more information contact James E. Myles (416-252-7791) or Catherine Manor (214-761-9108).

Tutorial Week East and Southcon '82

The Computer Society of the Institute of Electrical and Electronics Engineers, Inc. (IEEE-CS), will hold a week of tutorials March 22–26, 1982, at the Orlando Marriott Inn, Orlando, FL.

Participants may take up to five tutorials for the full-week registration fee of $400 (IEEE members) or $500 (non-members). Registration fees for individual tutorials are $90 for IEEE members and $110 for non-members.

For further information and a program for Tutorial Week East, contact Tutorial Week East, IEEE Computer Society, PO Box 639, Silver Spring, MD 20901.

The annual IEEE Southcon '82 will be held March 23–25 in Orlando and free shuttle service will be offered between Southcon and TWE. Southcon will feature over 50 technical sessions and over 500 exhibitors.

For further information on Southcon, write Dale Litherland, 999 North Sepulveda Blvd., Suite 410, El Segundo, CA 90245.

✓See List of Advertisers on page 210

NEW PRODUCTS

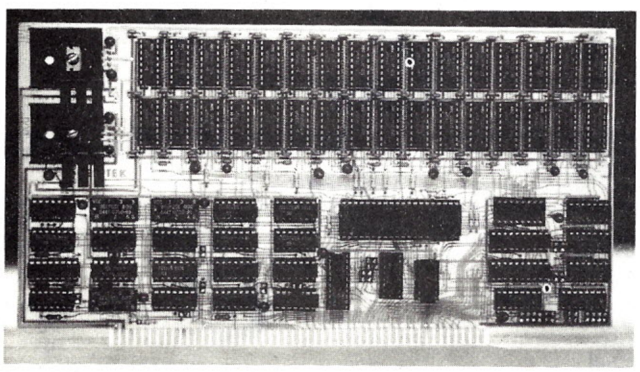
Edited by Linda Stephenson

Memory Expansion Boards
SS-50 Synthesizers
Mini-disk Storage Systems
Epic Microcomputer
Apple Speedup

Field-Expandable Memory Board

Teletek's new S-100 memory boards can be furnished with any of three different random access memory devices—4116, 4516 or 4164 chips. The basic board is a 64K-byte bank-select unit with memory deselection on any 4K boundary. The board is normally supplied with 4116s for any version between 16K and 64K bytes. It can later be expanded up to 256K. The 128K, 192K or 256K versions are populated with 4164 chips. The unit operates at 4 MHz with no wait states, and will operate at 6 MHz with one wait state. It can be used with a wide range of 8080, Z-80, 8085 or Alpha Micro processors.

Teletek, 9767F Business Park Drive, Sacramento, CA 95827. Reader Service number 489.



Teletek's 64K–256K memory board.

Two Sound Products

Speech Systems, 38 W 255 Deerpath Road, Batavia, IL 60510, is offering two new products for the SS-50 bus. These versatile synthesizers can reproduce speech, music and sound effects. The Speak 'n'Sing 1 uses the SC-01 phoneme speech chip by Votrax to synthesize speech with an unlimited vocabulary. The Speak'n'Sing 2 uses the National Semiconductor Digitalker speech synthesis technique to reproduce a limited number of words with exceptional clarity. Both synthesizers incorporate their own FIFO buffers to free the processor for other tasks. This feature eases program development and is important in real-time applications. Music and sound effects are developed using an eight-bit digital-to-analog converter. Available software includes utility programs, games using speech as their output, several one- and four-voice music selections and sound effects, and is available on five-inch and eight-inch disks in both Flex 2.0 and Flex 9.0 formats. Speak'n'Sing 1 is priced at $219.95; Speak'n'Sing 2 is $239.95. Reader Service number 491.

Percom Data Company's disk storage system and adapter.

Mini-Disk Storage For AIM-65

Percom Data Company, 211 N. Kirby, Garland, TX 75042, is now supplying mini-disk storage systems for AIM-65, KIM and SYM computers, and an adapter which interfaces these computers to the System-50 SS-50 motherboard. The M-65/50 adapter permits expansion of an AIM-65, KIM or SYM with proven System-50 modules. The MFD mini-disk systems are available in one-, two- and three-drive units. A system includes a disk controller circuit card, disk-operating system, interconnecting cable, user's manual and the drives. Two controllers are available, one for the AIM-65 expansion bus and one for the System-50 bus. MFD drive systems are

JUDGE THE REST, THEN BUY THE BEST

Only GIMIX offers you **SOFTWARE SWITCHING** between **MICROWARE's OS-9** and **TSC's FLEX.** Plus you get the power of the GMXBUG system monitor with its advanced debugging utility, and memory manipulation routines. A wide variety of languages and other software is available for these two predominant 6809 Disk Operating Systems.

You can order a system to meet your needs, or select from the 6809 Systems featured below.

JUDGE THE FEATURES AND QUALITY OF GIMIX 6809 SYSTEMS

GIMIX' CLASSY CHASSIS™ is a heavyweight aluminum mainframe cabinet with back panel cutouts to conveniently connect your terminals, printers, drives, monitors, etc. A 3 position keyswitch lets you lock out the reset switch. The power supply features a ferro-resonant constant voltage transformer that supplies 8V at 30 amps, +15V at 5 amps, and −15V at 5 amps to insure against problems caused by adverse power input conditions. It supplies power for all the boards in a fully loaded system plus two 5 ¼'' drives (yes! even a Winchester) that can be installed in the cabinet. The Mother board has fifteen 50 pin and eight 30 pin slots to give you the most room for expansion of any SS50 system available. 11 standard baud rates from 75 to 38.4K are provided and the I/O section has its own extended addressing to permit the maximum memory address space to be used. The 2 Mhz 6809 CPU card has both a time of day clock with battery back-up and a 6840 programmable timer. It also contains 1K RAM, 4 PROM/ROM/RAM sockets, and provides for an optional 9511A or 9512 Arithmetic Processor. The RAM boards use high speed, low power STATIC memory that is fully compatible with any DMA technique. STATIC RAM requires no refresh timing, no wait states or clock stretching, and allows fast, reliable operation. The system includes a 2 port RS232 serial interface and cables. All GIMIX boards use gold plated bus connectors and are fully socketed. GIMIX designs, manufactures, and tests in-house its complete line of products. All boards are twice tested, and burned in electrically to insure reliability and freedom from infant mortality of component parts. All systems are assembled and then retested as a system after being configured to your specific order.

56KB 2MHZ 6809 SYSTEMS WITH GMXBUX/FLEX/OS-9 SOFTWARE SELECTABLE

With #58 single density disk controller **$2988.59**
With #68 DMA double density disk controller **$3248.49**
to substitute Non-volatile CMOS RAM with battery back-up, add 300.00
for 50 Hz export power supply models, add 30.00

Either controller can be used with any combination of 5" and/or 8" drives, up to 4 drives total, have data recovery circuits (data separators), and are designed to fully meet the timing requirements of the controller I.C.s.

5 ¼" DRIVES INSTALLED IN THE ABOVE with all necessary cables

	SINGLE DENSITY		DOUBLE DENSITY		
	Formatted	Unformatted	Formatted	Unformatted	
40 track (48TPI) single sided	199,680	250,000	341,424	500,000	2 for **$700.00**
40 track (48TPI) double sided	399,360	500,000	718,848	1,000,000	2 for **900.00**
80 track (96TPI) single	404,480	500,000	728,064	1,000,000	2 for **900.00**
80 track (96TPI) double	808,960	1,000,000	1,456,128	2,000,000	2 for **1300.00**

Chart shows total capacity in Bytes for 2 drives.

Contact GIMIX for price and availability of 8" floppy disk drives and cabinets; and 5" and 8" Winchester hard disk system.

128KB 2Mhz 6809 DMA Systems for use with TSC's UNIFLEX or MICROWARES's OS-9 Level 2

(Software and drives not included) **$3798.39**
to substitute 128KB CMOS RAM with battery back-up, add 600.00
for each additional 64KB NMOS STATIC RAM board, add 639.67
for each additional 64KB CMOS STATIC RAM board, add 988.64
for 50 Hz export power supply, add 30.00

***NOTE:** UNIFLEX can not be used with 5" minifloppy drives.*

GIMIX has a wide variety of RAM, ROM, Serial and Parallel I/O, Video, Graphics, and other SS50 bus cards that can be added now or in the future. Phone or write for more complete information and brochure.

THE SUN NEVER SETS ON GIMIX USERS

GIMIX Systems are found on every continent, except Antarctica. (Any users there? If so, please contact GIMIX so we can change this.) A representative group of GIMIX users includes: **Government Research and Scientific Organizations** in Australia, Canada, U.K., and in the U.S.; NASA, Oak Ridge, White Plains, Fermilab, Argonne, Scripps, Sloan Kettering, Los Alamos National Labs, AURA. **Universities:** Carleton, Waterloo, Royal Military College, in Canada; Trier in Germany; and in the U.S.; Stanford, SUNY, Harvard, UCSD, Mississippi, Georgia Tech. **Industrial users** in Hong Kong, Malaysia, South Africa, Germany, Sweden, and in the U.S.; GTE, Becton Dickinson, American Hoechst, Monsanto, Allied, Honeywell, Perkin Elmer, Johnson Controls, Associated Press, Aydin, Newkirk Electric, Revere Sugar, HI-G/AMS Controls, Chevron. **Computer mainframe and peripheral manufacturers,** IBM, OKI, Computer Peripherals Inc., Qume, Floating Point Systems. **Software houses;** Microware, T.S.C., Lucidata, Norpak, Talbot, Stylo Systems, AAA, HHH, Frank Hogg Labs, Epstein Associates, Softwest, Dynasoft, Research Resources U.K., Microworks, Analog Systems, Computerized Business Systems.

TO ORDER BY MAIL

SEND CHECK OR MONEY ORDER OR USE YOUR VISA OR MASTER CHARGE. Please allow 3 weeks for personal checks to clear.

U.S. orders add $5 handling if order is under $200.00. Foreign orders add $10 handling if order is under $200.00.

Foreign orders over $200.00 will be shipped via Emery Air Freight COLLECT, and we will charge no handling. All orders must be prepaid in U.S. funds. Please note that foreign checks have been taking about 8 weeks for collection so we would advise wiring money, or checks drawn on a bank account in the U.S.. Our bank is the Continental Illinois National Bank of Chicago, account #73-32033 Visa or Master Charge also accepted.

GIMIX INC. reserves the right to change pricing and product specifications at any time without further notice.

GIMIX Systems are chosen by the Pros because of quality, reliability and features.

GIMIX INC.

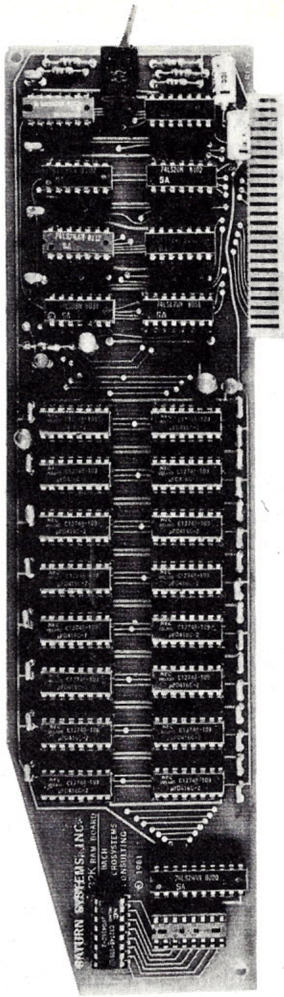
✓22

The Company that delivers

Quality Electronic products since 1975.

1337 WEST 37th PLACE, CHICAGO, IL 60609
(312) 927-5510 • TWX 910-221-4055

✓*See List of Advertisers on page 210*



Saturn Systems Expansion Board, available from Computer Data Services.

priced from $599.95. The M-65/50 interface costs $49.95. Reader Service number 486.

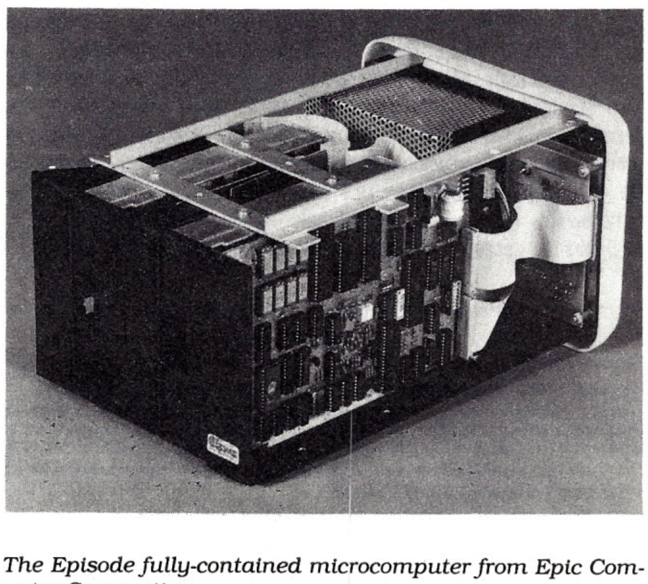
Double Your Memory

The 32K byte RAM Expansion Board from Saturn Systems provides twice as much memory as existing RAM cards. It is compatible with Microsoft CP/M and Z-80 Softcard, lets you run Pascal, FORTRAN, Pilot and other languages available for the Apple II, and increases VisiCalc memory by an additional 9K. The Saturn board comes with software that will automatically relocate DOS into one of the two 16K banks on the board—giving you Applesoft and Integer BASIC, DOS capability and 48K bytes with which to program on one board. Price is $239.

Computer Data Services, PO Box 696, Route 122, Amherst, NH 03031. Reader Service number 484.

A Compact Stand-Alone Computer

The Episode is a fully-contained Z-80A microcomputer that occupies about the same desk space as a legal document and is designed to interface with a wide variety of peripherals. The entire logic circuit, containing 64K-byte memory, dual serial I/O, Centronics-type parallel interface, floppy-disk controller and battery-powered calendar clock, occupies a single six-inch by eight-inch card. The Episode offers storage capaci-



The Episode fully-contained microcomputer from Epic Computer Corporation.

ties up to 1.6 megabytes on dual five-inch floppy-disk drives. Curly phone cord connections to the console and printer, fully internal diagnostic test circuitry and modem interface aid the Episode's expansion into network use. The computer interfaces with most CRT terminals and printers. Price is $2550, including CP/M and Supervyz software.

Epic Computer Corporation, 9181 Chesapeake Drive, San Diego, CA 92123. Reader Service number 483.

Auxiliary Processor Speeds Apples

The microSpeed Language System gives Apple users processing speeds up to 100 times faster than Applesoft BASIC. Developed from an extended version of Forth, the hardware/software package employs the Intel 8231A arithmetic processor with an interactive compiler to provide increased computer performance. The microSpeed system offers enhanced programming capabilities including print formatting, faster high-resolution plotting, turtle graphics and extended, high-speed mathematical functions. MicroSpeed II uses the 2 MHz version of the arithmetic processor, and microSpeed II+ uses the newer 4 MHz version. For a variety of numerical applications, microSpeed II users can expect a tenfold improvement in processing speed; microSpeed II+ offers a speed improvement approaching a factor of 20. Both systems include the auxiliary processor card and user's manual. MicroSpeed II is $495; microSpeed II+ is $645.

Applied Analytics Incorporated, 8910 Brookridge Drive, Suite 700, Upper Marlboro, MD 20772. Reader Service number 488.

Real-time flight simulator of a Vertical Attitude Takeoff and Land (VATOL) aircraft using the microSpeed Language System. The simulator is currently in use by the U.S. Navy.

Disposable Cleaning Disks

The Verbatim Datalife head cleaning kit removes up to 90 percent of debris contaminating magnetic recording heads used in computer and word processing systems. The kit consists of a durable, reusable Lexan jacket and presaturated, disposable cleaning disks. The cleaning disk is removed from its protective foil and polyethylene pouch, inserted into the Lexan jacket, and the whole assembly is put into the drive. The drive is turned on, and 60 seconds later the heads are clean. According to the manufacturer, competitive disks are made of PVC containing additives which, when exposed to the cleaning solution, are partially soluble and may contaminate the recording head, but Verbatim disks do not contain solvent-extractable plasticizing agents. Price for 10-pack of replacement disks is $20. (A free kit consisting of the Lexan jacket and two cleaning disks is offered through January 1982 with purchase of the 10-pack.)

Verbatim's Datalife magnetic head cleaning kit.

Verbatim Corp., 323 Soquel Way, Sunnyvale, CA 94086. Reader Service number 482.

Don't Bake Your Apple

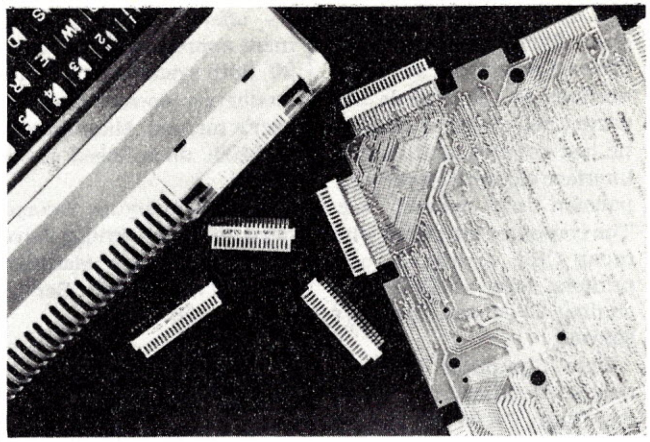
The Apple Cooler is designed to provide your computer system with a professional appearance and lots of fresh air. The smoked plexiglass Apple Cooler replaces the Apple's cover and has enough room for a nine-inch monitor and two drives. A Rotron muffin fan prevents the Apple's core from overheating—which could make it do some pretty strange things. Price is $159.50.

Concepts & Systems/Research Center, 553 Lancaster, PO Box 4041, Jacksonville, FL 32201. Reader Service number 492.

Gold Edge Plug For Model I

The Gold Plug 80 kit eliminates disk errors that occur because of oxidation of the tin/lead surface of the TRS-80 Model I expansion ports. It is a gold-plated card edge plug that is soldered directly to the existing tin/lead-plated card

The Apple Cooler from Concepts & Systems replaces the Apple's cover to provide forced cooling.



Gold Plug 80 kit from E.A.P.

edge plug on the Model I CPU and expansion interface ports. Compatibility remains the same. Installation requires disassembly of the keyboard/CPU and/or the expansion interface. The doors will not fit after installation of the Gold Plug 80. A full set for all six ports costs $54.95.

E.A.P., PO Box 14, Keller, TX 76248. Reader Service number 490.

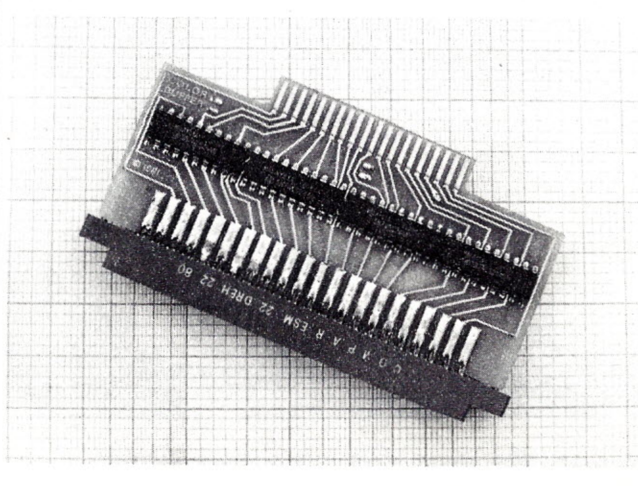
I/O Expansion Adapter

The Paddle-Adapple plugs into the game I/O, and is designed to operate in one of two modes. In the first, it lets you select either of two devices plugged into your Apple, such as a set of paddles or a joystick. It is no longer necessary to open your Apple to remove one device and plug in the other. In the second mode, the Paddle-Adapple takes advantage of the Apple's ability to handle up to four game controllers. The device plugged into one socket is treated as game controllers 0 and 1. The other device is treated as numbers 2 and 3. In either mode the Paddle-Adapple can be configured to exchange the x and y axes, reassign push button numbers and make other modifications. Programmers can now write games for four players, each with a paddle and push button. The Paddle-Adapple costs $31.45.

Southern California Research Group, PO Box 2231K, Goleta, CA 93118. Reader Service number 494.

Color Computer Enhancement

The TBH Color Buffer is a valuable peripheral for the Radio Shack Color Computer. The Color Buffer connects to



The Color Buffer from TBH.

The Commsoft Codem, a universal CW interface for microcomputers.

the system bus through the game slot cartridge; it terminates in the standard 22/44 card edge connector, providing the hobbyist or experimenter with easy access to fully buffered address, data and control lines. The Color Buffer also serves as a building block, letting the user plug in a variety of other peripherals. Price is $59.95 ($69.95 Canadian).

TBH Canada, 67-3691 Albion Road, Ottawa, Ontario, Canada K1T 1P2. Reader Service number 485.

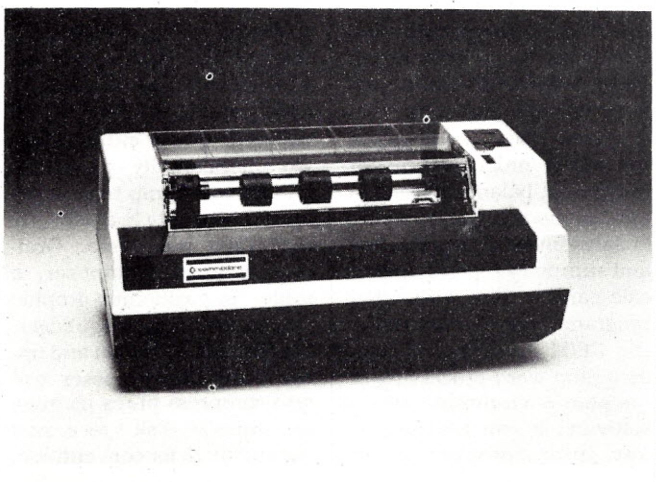
Interface for Radio Amateurs

The Codem provides an easy way to get Morse code software on the air. The Codem doubles as a code practice oscillator and CW regenerator; it converts received CW audio to RS-232 or TTL signal levels, and RS-232 or TTL signal levels to transmitter keying. A sharp 800 Hz bandpass filter, AM detector and low pass filter are designed into the Codem to provide noise and QRM rejection. CW can be monitored using an internal two-inch speaker or with an external high-impedance earphone. Front panel sensitivity, tone and volume controls are provided. The Codem requires an external 9 V dc power supply. The price is $129.95. The 9 V dc power supply is $9.95.

Commsoft, 665 Maybell Ave., Palo Alto, CA 94306. Reader Service number 493.

VIC Graphics

Commodore Business Machines, Inc., Computer Systems Division, 681 Moore Road, King of Prussia, PA 19406, has announced a dot matrix printer for its VIC 20 microcomputer. The VIC 1515 can print any of the alphabetic, numeric and graphics symbols common to the VIC 20, at a speed of 30 characters per second. Special enhancements also allow the VIC 1515 to print extra-wide and reversed (negative) characters. The printer is priced at $395. Reader Service number 487.

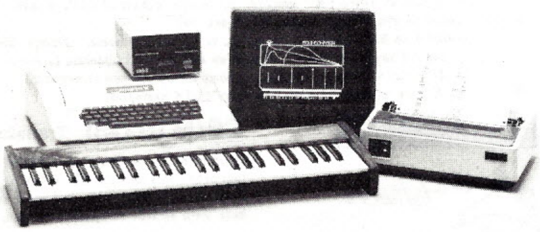


The VIC 1515 dot matrix printer from Commodore.

NEW SOFTWARE

Edited by Linda Stephenson

A Sound Investment
Graphics on Display
Mail-Mate for Your Apple



Software packages from Passport Designs expand the Soundchaser's musical talents.

Two New Music Programs

The Soundchaser polyphonic synthesizer now performs as a music transcriber and a music educator, using new software packages from Passport Designs, Inc., 785 Main St., Suite E, Half Moon Bay, CA 94019.

The Notewriter program turns Soundchaser into a real-time music transcriber. The notes you play on the music keyboard will be written on the screen in standard music notation. Editing features facilitate quick changes in tempo, key signature, phrasing, thematic material and other aspects of music notation. The score can be printed out with a graphics printer.

Musictutor software turns Soundchaser into an educational tool. Programmed learning courses in ear training, music theory and harmony can be used to develop skills and basic musicianship. Price for Notewriter is $100; Musictutor costs $150. Reader Service number 474.

Statistics for the TRS-80

Statistical Package for Microcomputers (SPM) is available for the TRS-80 Model I or III from Bruce P. Douglass, 20 Willow, Vermillion, SD 57069. SPM consists of five programs that perform descriptive statistics, analysis of variance and single- and multiple-variable regression. It features analysis of variance with unequal sample sizes, exceptional flexibility in formatting post hoc and planned comparison analysis and computation of percentile ranks of F ratio statistics.

All the programs allow for easy input, output and editing of data. SPM is supplied on cassette for $41.95. Reader Service number 467.

Shadow Hawk

A new game with triple-axis, high-resolution, three-dimensional color graphics is offered by Horizon Simulations, 107 E. Main, Medford, OR. The Galactic Empire has conquered the entire solar system; imperial merchant ships carrying essential materials link the planets and their moons; and the Empire's combat ships patrol space, in which deadly satellite battle stations are suspended. The vanquished Confederation of Free Space, however, has one last weapon: Shadow Hawk I, the swiftest little warcraft in the solar system. Its valiant commander is the lone player of the game, and his challenge is to engage the enemy against insurmountable odds. End game success is measured by progress achieved before defeat. Shadow Hawk is available on disk for Apple II or Atari 800, 48K, with disk drive and joysticks. Price is $49.95. Reader Service number 468.

Electronic Worksheet Program

Supercalc prepares an electronic ledger on the display of the Z-89 microcomputer and lets the user enter text or numeric information and perform calculations. The most common uses of electronic worksheet programs are for budgeting, balance sheets, financial modeling, forecasting of sales/inventory/production and summary reports. Supercalc can be used with other programs which run under the CP/M operating system, including word processing or telephone communications software. It can be used on any microcomputer with CP/M, but modificatons to Supercalc have been made that take advantage of special function keys on 48K-byte Zenith Data Systems or Heathkit microcomputers. A help command provides access to explanations without referring to a manual. Problems requiring changes in calculations (such as price breaks based on sales volume) are handled with conditional formulas. Changes to important information can be prevented by using a protect command. Supercalc is available on five- or eight-inch disks. Price is $295.

Zenith Data Systems, 1000 Milwaukee Ave., Glenview IL 60025. Reader Service number 470.

Hi-Res Dump Routines

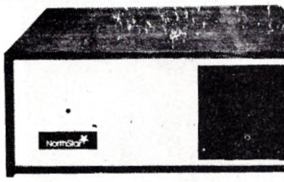
Grafpak is a family of high-resolution graphics dump programs for use with the Apple II, or with the Apple III in Apple II emulator mode. Grafpak offers a wide range of scale factors for dumping hi-res pictures, limited only by your printer's dot density and carriage width. Every Grafpak will dump either hi-res page horizontally or vertically, and will dump both pages butted vertically in a perfectly registered panorama. Grafpak includes Composer, a utility for positioning graphic images, cropping image edges, white/black inversion and image framing. Composer will also compress hi-res pictures to minimize disk space, and expand them for conventional display. Grafpaks are available for Epson Graftrax, priced

TO ORDER ONLY CALL TOLL FREE 1-800-526-7470

MICRO MERCHANTS

31

NORTH STAR
In Stock



North Star Horizon 2
Special

64K - 1 - Disk Drive
1 - 5¼ Meg Hard Disk Drive
CPM 2.2 + All Software
To Run Hard Disk
$6599.00

POWERFUL NORTH STAR BASIC FREE
SUPERB FOR BUSINESS & SCIENCE

Factory Assembled & Tested	List	Only
Horizon-2-64K-Double Den	$4195	$3125
Horizon-2-32K-Quad Density	$3995	$3040
Horizon-2-64K-Quad	$4495	$3420
Horizon Ram ASSM	16K = $279	32K = $489
Horizon Ram ASSM	48K = $679	64K = $881
Horizon Disk Drive Sale Double Den	SAVE!	
North Star Hard Disk 18 Mb	$5375	$4300
North Star Time Sharing Multi-User		CALL

ATARI 800
(16K) PERSONAL/BUSINESS COMPUTER

- Computer Console
- Atari 8K Basic
- 57 Full Stroke Alpha-numeric keys & (4) Function Keys
- Operators Manual
- RF Modulator
- Power Supply

CALL FOR PRICE

*Add'l 16K RAM FREE w/Purchase of System

ATARI OPTIONAL ACCESSORIES

Model #	Description	Price
810	Disk Drive System	$ 475
815	Disk Drive System	$1199
820	40-col. Dot Matrix Printer	$ 279
822	40-col. Thermal Printer	$ 349
825	80-col. Dot Matrix Printer	$ 625
830	Acoustic Modem	$ 159
850	Interface Module	$ 139
410	Cassette Recorder	$ 60

ATARI SOFTWARE

Description	Price
Basketball	$30.00
Super Breakout	$30.00
Chess	$30.00
Video Easel	$30.00
3-D Tic Tac Toe	$30.00
Star Raiders	$34.00
Music Composer	$42.00
Educational System ROM	$19.95
Assembler/Editor	$45.00
Telelink I	$19.95
Space Invaders	$15.95
Kingdom	$12.95
Blackjack	$12.95
Biorhythm	$12.95
Graph It	$15.95
Energy Czar	$12.95
Mailing List	$16.95
Statistics I	$16.95
Paddle Controls	$17.95
Joysticks (pair)	$17.95
Touch Typing	$19.95
Stock Charting	$19.95
Stock Analysis	$19.95
Bond Analysis	$19.95

MANY MORE AVAILABLE

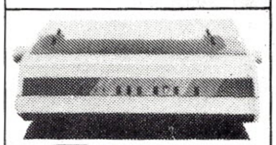
MasterCard and VISA Accepted

APPLE SOFTWARE
by EDU-WARE

Description	Price
COMPU-MATH (FRACTIONS)	$29.95
COMPU-MATH (DECIMALS)	$29.95
COMPU-READ	$19.95
EDU-PAK I	$35.00
TERRORIST	$24.95
WINDFALL	$16.95
NETWORK	$16.95
SPACE	$24.95
PRISONER	$24.95

(ALL SOFTWARE ON DISK)

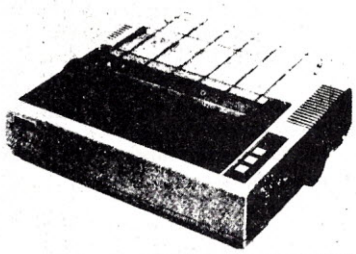
commodore



Qume

CALL FOR PRICE

EPSON MX-80 PRINTERS



Among its features, the MX-80 prints 96 ASCII, 64 graphics and 8 international character in tack-sharp 9x9 matrix. It prints bidirectionally at 80 CPS with a logical seeking function to maximize all of these capabilities. And it has the world's first disposable print head, with a life expectancy of over 50 million characters. When it wears out, just snap it out and throw it away! A new one costs less than $30., and you can install it yourself...with one hand.

The most revolutionary thing about the Epson MX-80 isn't the bidirectional printing or the logical seeking function. It isn't even the disposable print head - although that's pretty revolutionary. The most revolutionary thing about the MX-80 is the price.

EPN-MX80	MX80 Tractor Feed List $649. SALE PRICE	$495
EPN-MX80V2	MX80 with Graphics option	$560
EPN-MX80TF	MX80 with both tractor and friction feed	$610
EPN-MX82	MX80 with high density graphics option	$610

commodore

VIC-20	$ 289
4032N	$1080
8032	$1499
CBM 4022 Printer	$ 669
CBM 4040 Drive	$1039
CBM 8050 Drive	$1449
CBM C2N Drive	$ 87
PET-IEEE Cable	$ 37
IEEE-IEEE Cable	$ 46

PROFESSIONAL SOFTWARE

WordPro 1 8K	$ 29.95
WordPro 3 (40 Clm.) 16K	$199.95
WordPro 3 +	$295.00
WordPro 4 (80 Clm.) 32K	$375.00
WordPro 4 +	$450.00

ZENITH data systems

Z80-FA
List $2895
Our Price **$2395**

NOW IN STOCK

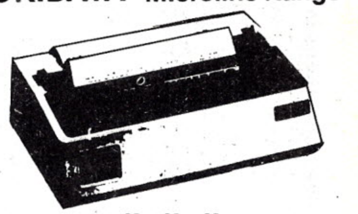
Z-89GA with CP/M 2.2 List: $2595, Less Disk	$2149
A-87 Two Drive Minifloppy System List: $1195	$ 989
Z-47DA 8" Two Megabyte Disk System List: $3695	$3059

ZENITH data systems

Z19 Video Terminal
Limited Time **$799**

List: $995

OKIDATA Microline Range



80 • 82 • 83
CALL FOR PRICES

The small, quiet, light, highly dependable printer with three way paper handling. Single sheet/roll/pin feed.

NEC SPINWRITER™

Terminal/Keyboard as well as RO Printer Only Models Available.

CALL FOR PRICES!

MISCELLANEOUS/SUPPLIES

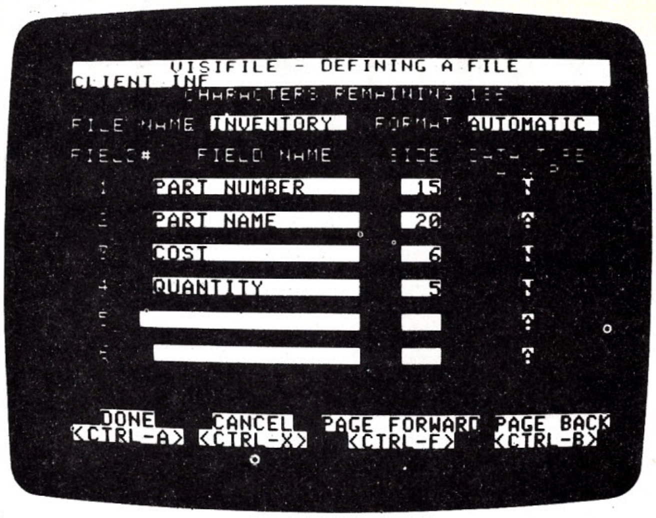
DISK DRIVES — Call for Prices

Quality Software for:*

ATARI	TRS-80 (Level II)**
PET	NORTH STAR
APPLE II Plus	CP/M Disks/Diskettes

ORDERING INFORMATION: Phone orders invited using VISA, MASTERCARD or bank wire transfers. VISA & MC credit card service charge of 2%. AE credit card service charge of 5%. Mail order may send charge card number (include expiration date), cashier's check, money order or personal check (allow 10 business days to clear.) Please include a telephone number with all orders. Foreign orders (excluding Military PO's) add 10% for shipping. All funds must be in U.S. dollars (letters of credit permitted). Shipping, handling and insurance in U.S. add 3% (minimum $4.00). New Jersey residents add 5% sales tax. Our low margins prohibit us to send COD or on purchase orders or open account (please send for written quotation). All equipment is subject to price change and availability. Equipment is new and complete with the manufacturer warranty. We do not guarantee merchantibility of products sold. All returned equipment is subject is subject to a 15% restocking fee. We ship most orders within 2 days.

181 ROUTE 46 WEST, LODI, N.J. 07644 — **MICRO MERCHANTS Division Comtek Electronics, Inc.**



Formatting Personal Software's VisiFile screen for data entry.

at $34.95; for Anadex Grafix-Plus at $39.95; for Integral Data Dot Plot IDS 440–445 at $29.95 and IDS 460–560 at $39.95; and for NEC PC-8023A-C at $34.95.

SmartWare, 2281 Cobble Stone Court, Dayton, OH 45431. Reader Service number 473.

Electronic Filing

File management on a personal computer is fast and simple with VisiFile from Personal Software, 1330 Bordeaux Drive, Sunnyvale, CA 94086. The program stores, sorts and prints inventory, client lists and records, sales information, medical records and other word or numerical data. The VisiFile FlexFormat feature lets the user change, rearrange and add unforeseen information or combine records into new files. For example, the change from a five-digit to nine-digit zip code could be made without retyping all the data. VisiFile communicates with other Visi software for efficient handling of information. Price is $250. Reader Service number 466.

Legal Dictionary

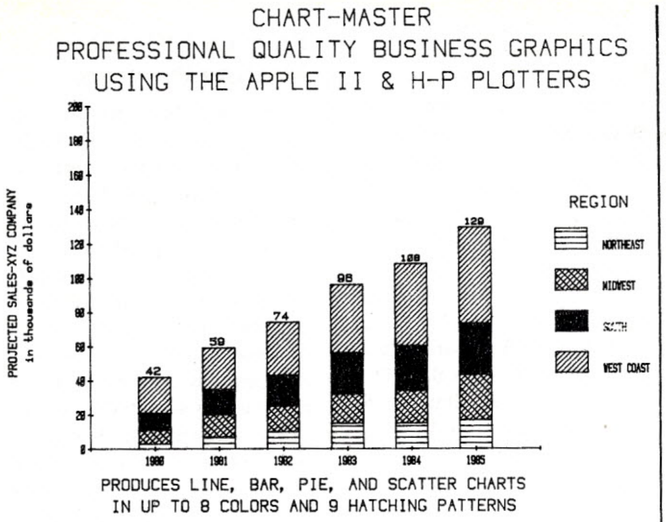
SP-Law Dictionary is a Spellguard-compatible program that checks the spelling in legal documents. It has a 15,000-word lexicon of legal terms and reference words, including Latin phrases frequently used in law offices. Another 20,000 commonly used English words come with the basic Spellguard program. These 35,000 words require 80K bytes of disk storage. With the SP-Law Dictionary and Spellguard, users can proofread over 15,000 words in one minute on a double-density floppy system. SP-Law Dictionary runs on a microcomputer with a minimum of 32K bytes of memory, at least one floppy disk drive and the CP/M operating system. It requires Spellguard and a word processing program that uses the same configuration. SP-Law Dictionary is available on a five-inch or eight-inch disk for $125.

Innovative Software Applications, 260 Sheridan Ave., Suite 300, Palo Alto, CA 94306. Reader Service number 464.

Business Graphics For the Apple

Software Resources, Inc., 186 Alewife Brook Parkway, Suite 310, Cambridge, MA 02138, announces Trend-Spotter, a business graphics and forecasting analysis package. Trend-Spotter will generate color graphics displays, calculate and display trend lines, perform mathematical and statistical computations, print graphic and tabular data, and edit and update data files. Trend-Spotter can generate and read VisiCalc-compatible files. The system requires an Apple II+ with 48K bytes of memory, disk drive and monitor. A second disk drive and printer are useful. Price is $175.

Software Resources, Inc., 186 Alewife Brook Parkway, Suite 310, Cambridge, MA



Business graphics from Chart-Master.

02138. Reader Service number 465.

Business Graphics Program

Chart-Master combines the talents of the Apple II or III microcomputer with a Hewlett-Packard plotter to produce eight-color business graphics. The interactive menu-driven program lets the user create, edit, store and plot bar graphs, line and pie charts and scatter diagrams as well as text pages, signs and abstract graphics. Chart-Master offers a variety of hatchings and line types, linear regression and curve fittings and output on bond paper or acetate. The program interfaces with VisiCalc, allowing the user to easily and quickly plot selected rows and columns from any VisiCalc model. Price is $375.

Decision Resources, 44 White Birch Road, Weston, CT 06883. Reader Service number 472.

BASIC-to-TI 58/59 Translator

You can create keystroke programs for programmable calculators with a new computer software product from Singular Systems, 810 Stratford, Sidney, OH 45365. The BASIC-to-TI 58/59 Cross Compiler automatically translates BASIC programs into keystroke programs for Texas Instruments TI 58 and TI 59 calculators. The user can conveniently develop, refine and test his programs in BASIC, taking advantage of the high-level language's editing and debugging features. The programs can then be compiled on the same machine into an equivalent keystroke program for the calculator. Extended features of the Cross Compiler include keystroke optimization, complete keystroke program listing, listing of BASIC variables used and their corresponding calculator memory registers, listing of calculator labels used, and recognition of standard and nonstandard BASIC commands and functions. Price is $65 for BASIC program listing, user's manual and documentation. The BASIC source program is also available in card image format on 9-track tape for an additional $35. Reader Service number 480.

Star Warrior for Atari Computer

Star Warrior is a fast-action science fiction adventure for the Atari 800. The Star Warrior player is an interplanetary avenger who must single-handedly oppose an entire planetary force of storm troopers. The avenger can walk, jump—or even fly—over swamps, forests and mountains. S/he is armed with sophisticated electronic direction-finding equipment, decoys to fool the enemy, nuclear missiles, blaster and powergun. In addition to several suits of armor, the player can also choose either of two scenarios. In the first, the enemy must be directed away from the main attack, while the

See List of Advertisers on page 210

player destroys as many military installations as possible in a predetermined time limit. In the second scenario, the player must track down and destroy the tyrannical military governor and staff. But the governor is always on the move, so the player never knows where to look. Star Warrior has 19 command options and five levels of skill, with sound effects and graphics display. Price is $39.95.

Automated Simulations, PO Box 4247, Mountain View, CA 94040. Reader Service number 476.

New 6809 Cross Software

A relocatable cross assembler, relocatable cross compiler and cross linker for the 6809 microprocessor are available from Wintek Corp., 1801 South St., Lafayette, IN 47904. The assembler supports nested macros and conditional assembly. The PL/W compiler supports a high-level language styled after IBM's PL/1. PL/W is a block structured language which supports control structures required for structured programming. Also available is a floating point/scientific package for easy access to floating-point arithmetic and scientific functions. All programs are written in ANSI standard FORTRAN (X3.9-1966) for 16-bit or larger machines. Prices are approximately $1000 per program or $3400 for the complete package. Reader Service number 475.

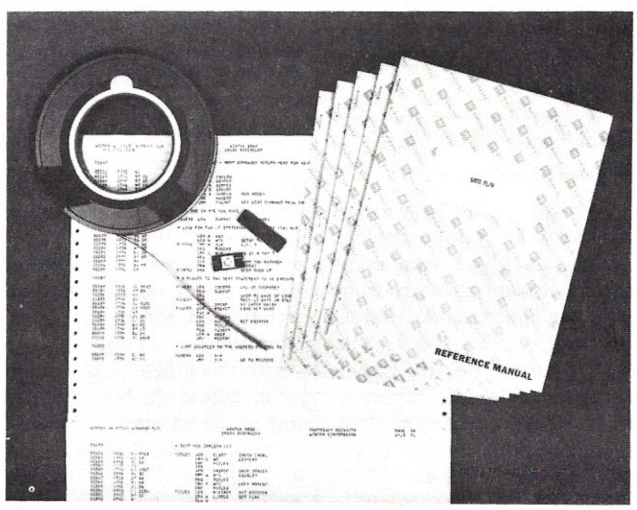
Fast and Flexible Mailing Program

The Mail Mate mail-merge package operates with Magic Window word processing system or as a stand-alone mailing/phone list program. To merge letters produced from Magic Window, the user produces a soft copy in the printer subsystem; Mail Mate then accesses the soft copy and merges it with the addresses and names selected from the user's address list. The highlights of the system are an extremely quick sort, string search on names of uncertain spelling, 10 selection fields (36 acceptable alphanumeric codes per field) and flexible specification of selection codes for printing and logical AND specification between selection fields. It runs on an Apple II with at least one disk drive. Price is $68 ($85 in Canada).

Evolution Software, Inc., 1632 Bathurst St., Toronto, Ontario, Canada M5P 3J5. Reader Service number 471.

Stereo Images

The Stereo Generator runs on a 48K Apple II+ and lets the user define, manipulate and view three-dimensional objects. The easy-to-use program is of special interest to students of coordinate systems, analytic geometry, drafting, physics and graphic arts. The user defines arbitrary three-dimensional objects comprising up to 65 points in space connected by



Wintek Corp. has a cross assembler, cross compiler and cross linker for 16-bit machines.

up to 170 line segments. The program then generates stereoscopic image pairs on the second high-resolution screen, so the object is perceived in three dimensions. The game paddles rotate the object 360 degrees about each of two body axes. Generation time varies from one to 15 seconds, depending upon complexity of the object. Subroutines allow control of display modes, scale factors, depth perception, object definition, image superimposition, orientation sequences, disk control and optional printing. The program is available on DOS 3.2 or 3.3 disks. Program, stereo viewer and complete documentation cost $36.95.

R-Alpha Software, Box 3332, Crofton, MD 21114. Reader Service number 478.

CP/M Data Comm

Intercom communications software for the CP/M operating system is available for the TRS-80 Model II, Cromemco, Zenith, Ohio Scientific and Apple II computers. The package, written in 8080 code, is designed for interactive communications and verified quantity file transfers (including object files) using several standard protocols. Other features include four automatic sign-on routines, four user-definable routines, batch mode for unattended operation, and CP/M system-level commands including directory with disk space utilization. Price is $75.

End of File, Inc., 3140 E. Shadowlawn Ave., Atlanta, GA 30305. Reader Service number 479.

Color Computer Game

Mark Data Products, 23802 Barquilla, Mission Viejo, CA 92691, introduces Color Berserk, a new high-resolution graphics game for 16K Radio Shack Color Computers. Color Berserk resembles the popular arcade game, with dynamite sound effects and super joy stick action. Angry robots and Evil Orville combine to provide hours of challenging play for one or two combatants. Color Berserk is available on cassette for $24.95. Reader Service number 481.

Apple Business Planning

The Depreciation Planner runs on an Apple microcomputer and keeps track of depreciable assets for accounting and tax planning purposes. It incorporates earlier depreciation methods (for assets purchased before January 1981), and the new depreciation methods. It is faster than manual record keeping, and reduces paperwork and chance of error. The user determines cost, salvage amount, useful life and special restrictions or conditions pertaining to the asset and depreciation method. Once these figures are entered, Depreciation Planner automatically keeps track of each asset, calculates current month depreciation, year-to-date and life-to-date amounts, and prints lists of assets according to the user's requirements. The Depreciation Planner can work independently, or it will interface with The Controller or The Business Bookkeeping System and automatically post depreciation amounts to the General Ledger and update current amounts for each asset. Price is $395.

Dakin5 Corporation, 7475 Dakin St., Fourth Floor, Denver, CO 80221. Reader Service number 477.

Overlay Compiler

An overlay structure is now possible under an extension to the Comstar compiler for North Star BASIC. An overlay differs from program chaining in that a root program segment and selected program variables can survive intact as a new program segment is introduced. An overlay structure allows very large programs to be executed and is also suitable for a menu-driven system of programs. The overlay extension is available for $75 to registered owners of the Comstar compiler and includes a CP/M overlay capability for those with the Comstar-CP/M interface.

Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107. Reader Service number 469.

✓See List of Advertisers on page 210

Letter-Perfect Mail Program

Muse's Form Letter For Apple II

Form Letter Module

I recently received an invitation from a publisher to write a book. This was quite flattering, until I realized he had merely typed my name and address on a printed form letter which was general enough to apply to all writers on his mailing list. His list is evidently composed of all contributers to *Microcomputing* and other computer magazines.

How much more effective his letter would have been if it had mentioned the name of my article and the name of the magazine in which it had appeared! At 20 cents a clatter for first-class postage, form letters need all the help they can get.

Muse Software, Inc. (330 North Charles St., Baltimore, MD 21201), has released a program for the Apple II that allows its user to "personalize" a form letter to the extent that the addressee *has* to believe the sender sat down and wrote a letter just to him.

This program, called the Form Letter Module, runs with Super-Text II (also by Muse), merging text with variables to produce a highly personal letter. Add to it Muse's Address Book program, and you have a fully automatic system for writing personal messages to everyone on your list. The programs require 48K bytes of RAM and at least one disk.

Here's how the package works:

First, you create a mailing list with Address Book. The list may have as many as 700 addresses on one disk, each address containing eight variables: name, company, street, city, state, zip, phone and category.

The Form Letter Module can extract up to 18 variables from these eight entries. For example, NAME = DR. PETER P. PAINE DDS. can be used in the Form Letter Module as:

$Name	Dr. Peter P. Paine Dds.
$Title	Dr.
$Fname	Peter
$Lname	Paine
$SUFFIX	DDS
$Bname	Peter P. Paine
$Nickname	Pete (when used with NICKNAMES file).

The addressee has to believe the sender sat down and wrote a letter just to him.

Note that capitalization in text is controlled by the way the variable name is capitalized.

If the publisher had used the Form Letter Module in his letter to me, he may have taken some liberties with Address Book and entered my address as shown in Sample 1, or someone else's as in Sample 2.

Then, he would go to Super-Text II an write a letter something like that showr. in Sample 3. The letters as printed out would be highly personal as shown in Samples 4 and 5, and yet would still have the timesaving attributes of an automated form letter.

Note that I have taken some liberties with the Address Book format, making the suffix of the addressee's name equal the name of the magazine in which his article appeared, and the phone number the issue date. You could achieve the same purpose in a number of ways, and this is not necessarily the best one. The point is, the programs are versatile and forgiving.

Note also the IF statement in the body of the letter. This function (used in its simplest form in the example) opens up a whole world of possibilities. The letter could contain a zillion IF statements, with a different element of text to be

NAME	MR. DAVID C. GOODFELLOW MICROCOMPUTING
COMPANY	SO I BOUGHT THIS COMPUTER
STREET	P.O. BOX 66834
STATE	WASHINGTON
ZIP	98166
PHONE	NOVEMBER 1980
CATEGORY	WR

Sample 1.

NAME	MS. JULIE P. WRITER BRAND-X-MAG.
COMPANY	MICROPROCESSOR MADNESS
STREET	6618 3RD E.
CITY	ANYTOWN
STATE	WASHINGTON
ZIP	98111
PHONE	FEBRUARY 1981
CATEGORY	WR

Sample 2.

```
$Date



$Title $Bname
$Street
$City, $STATE-CD $ZIP

Dear $Title $Lname:

We noticed your fine article, "$Company," in the $Phone issue of
$SUFFIX   We'd very much like you to consider the possibility of
writing a book for us on that subject or another computer subject
in which you have expertise.

.IF $TITLE = "MS.":
Women are still considered something of a rarity in this highly
technical field, so we believe your contribution would be well
received.
.ON

Etc., etc., etc......

Sincerely,



John P. Publisher



                                          $Title $Bname
                                          $Street
                                          $City, $STATE-CD $ZIP
```

Sample 3. Form letter as originally typed, with embedded commands. The last three lines are preceded by a STOP code and a formatting command, which are invisible in this printout. These lines address the envelope. When running continuous form letterhead, omit these lines and print the addresses separately.

```
April 3, 1981



Mr. David C. Goodfellow
P.O. Box 66834
Seattle, WA 98166

Dear Mr. Goodfellow:

We noticed your fine article, "So I Bought This Computer," in the
November 1980 issue of MICROCOMPUTING.  We'd very much like you to
consider the possibility of writing a book for us on that subject
or another computer subject in which you have expertise.


Etc., etc., etc......

Sincerely,



John P. Publisher
```

Sample 4. Sample letter from first record on Address Book. Note the article title, magazine name and date of issue extracted from the address file and merged with the text.

plugged in for each. The result would be that a single form letter would have an entirely different content for different addressees.

Details

If you do not wish to use Address Book with the Form Letter Module, the latter program will prompt you for names and addresses. This works quite well, but I for one would rather use Address Book.

When printing out letters from your mailing list, you may search for any of the variables, and print letters only to those which satisfy your search criteria. This is good for limiting your letters to a

April 3, 1981

Ms. Julie P. Writer
66618 3rd E.
Anytown, WA 98111

Dear Ms. Writer:

We noticed your fine article, "Microcomputer Madness," in the February 1981 issue of BRAND-X-MAG. We'd very much like you to consider the possibility of writing a book for us on that subject or another computer subject in which you have expertise.

Women are still considered something of a rarity in this highly technical field, so we believe your contribution would be well received.

Etc., etc., etc......

Sincerely,

John P. Publisher

Sample 5. Sample letter from second record on Address Book. Note that $TITLE satisfied the IF statement, so the second paragraph was printed.

certain area, profession, etc.

The programs are so easy to use and well-documented that the beginner can be using them effectively within an hour or so. As he uses them, he will find their capabilities limited only by his own imagination.

The programs could just as easily be applied to existing customers, with the same basic letter congratulating some on their prompt payment, reminding others that a payment is overdue and warning still others that their credit rating is in jeopardy.

The Form Letter Module *requires* Super-Text II, and works best when Address Book is added to the package. The whole package adds up to about $300—$150 for Super-Text II, $100 for Form Letter Module and $49.95 for Address Book.

Conclusion

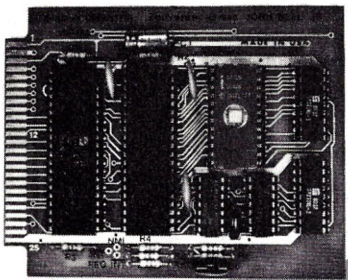
On a scale of one to ten, I would rate the whole package at about 18. If a review should expose deficiencies in the subject program, this review is sadly lacking. The truth is, I could find no problems of any consequence—only a software package that I, in my business, would not be without.

David C. Goodfellow
Seattle, WA

BARE BOARD SALE $19.95*

LIMITED OFFER

Z80 MICROCOMPUTER

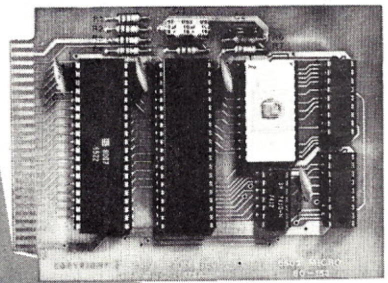


Z-80 MPU, Z-80 PIO, 2716 EPROM 2114 RAM single board computer. Single 5 volt power supply at 300 Ma. Two independent 8 bit I/O ports with handshake lines. RC controlled 2MHz clock.

Complete documentation. I/O lines use 50 pin edge connector data and address lines are not accessible. Mod. for 2532 is included. EPROM is not included. 1K RAM, 2K EPROM, 2 I/O ports.

80-280 Assm.	**$129.95**
80-280 Kit	**$119.95**
80-280 Bare Board	**$ 19.95**

6502 MICROCOMPUTER

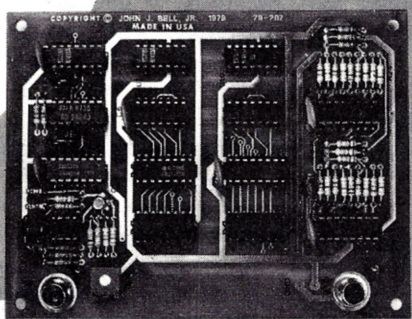


6502 MPU, 6522 VIA, 2716 EPROM 2114 RAM single board computer. Single 5 volt power supply at 400 Ma. Two independent 8 bit I/O ports with handshake lines. RC controlled 1 MHz clock.

Complete documentation. I/O lines use 50 pin edge connector data and address lines are not accessible. Mod. for 2532 is included. EPROM is not included. 1K RAM, 2K EPROM, 2 I/O ports.

80-153 Assm.	**$110.95**
80-153 Kit	**$ 89.95**
80-153 Bare Board	**$ 19.95**

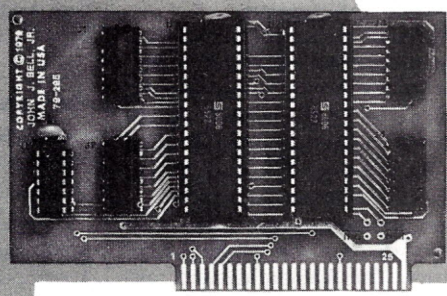
A-D & D-A CONVERTER



A-D and D-A on one board uses 2 16 pin DIP connectors for data and phono jacks for analog I/O. A-D conversion time 20μs D-A conversion time 5μs. 8 bits wide Latched data and strobe lines. Single 5 volt 400 Ma. power supply. Designed for speech.

79-287 Assm.	**$79.95**
79-287 Kit	**$59.95**
79-287 Bare Board	**$19.95**

6522 APPLE II INTERFACE



Two 6522 VIAs on a single board for the apple. Four software programmable 8 bit I/O ports connect through 4 16 pin dip sockets. Interrupt jumpers for IRQ and NMI. 4 16 bit timers. Inputs and outputs are TTL compatible.

79-295 Assm.	**$69.95**
79-295 Kit	**$59.95**
79-295 Bare Board	**$19.95**

JOHN BELL ENGINEERING, INC.

ALL PRODUCTS ARE AVAILABLE FROM **JOHN BELL ENGINEERING** • P.O. BOX 338 • REDWOOD CITY, CA 94064

MC

ADD SALES TAX IN CALIFORNIA • ADD 5% SHIPPING & HANDLING 3% FOR ORDERS OVER $100 10% OUTSIDE U.S.A.

VISA

SEND FOR CATALOG

(415) 367-1137

Three Books for Beginners
6502 Software Design
From ENIAC to UNIVAC

Small Computers

Fred D'Ignazio
Franklin Watts, 1981, 146 pp.

Book publishers are responding to the mushrooming use of microcomputers in classrooms with a flood of introductory books for school kids. *Small Computers* is the author's third effort in explaining micros to students.

D'Ignazio offers almost no information on the developmental history of computers, preferring to start with the present status and proceed to future uses and problems. His view includes single-purpose devices as well as user-programmable ones. In fact, by choosing a digital watch for illustrating the elements of programming, he is able to limit the discussion to programming only, without getting into peripheral concerns.

The virtues of doing one's own programming are particularly stressed. The author introduces the concept of building models of real-world situations, and declares that in mastering programming skills, one has the glue with which to construct any such model on a computer.

The most impressive part of the book deals with computers and programming of the future. The fascinating and tantalizing truth is that this future is almost upon us. Bubble memories, the Josephson computer and sophisticated voice-recognition/synthesizing capabilities are all covered briefly, but I found myself wanting more than the six pages devoted to Xerox Corporation's Smalltalk language and programming system. This system's computer, Dynabook, is expected to shrink to the size of a notebook by the mid-1980s. To this reader, schooled in the limitations of BASIC, the capabilities of Smalltalk are mindboggling, and yet any visitor to Xerox's Palo Alto facility can experiment with it today.

Rather than paint a totally rosy picture of our computerized future, D'Ignazio also shows us the darker side of what that future might bring. Sections on computer sabotage, information burglary and the possibility of a truly Orwellian 1984 warn that we must proceed with extreme caution: we must not accept this brave new world blindly.

The appendices on books and magazines are very up-to-date, and although not exhaustive, they do list only those items which are easily accessible. An excellent 12 page glossary is also included.

Many current offerings in this field are written by generalist free-lancers. Fred D'Ignazio, however, is a programmer/analyst and a Ph.D. candidate in computer science, and his book shows it. Ostensibly it is aimed at a high school audience, but there is nothing about the language, and very little about the illustrations, that would confine its use to that age level. The curious adult layman might well find *Small Computers* the best books for beginners in this often bewildering field.

Computers in Your Life

Melvin Berger
Thomas Y. Crowell, 1981
117 pp., $8.79

Computers in Your Life is aimed at the junior high school student. Berger is not a computer expert, but has published over 60 books on a variety of subjects for young readers, many of them to considerable critical acclaim.

He begins with a short grabber chapter, in which several urgent situations are resolved by computers. Then he introduces the computer itself, covering briefly but adequately its first three generations; i.e., vacuum tube, transistor and modern large-scale integrated circuits. Each of the five parts of a computer—input, storage, control, processor and output—is described.

The remaining chapters are devoted to individual areas of computer applications. They cover medicine, communications, transportation, business and industry, education, games, law enforcement and government with the author skillfully shifting from narrative to dramatic vignette to the "what-if" technique.

There are over three-dozen clear photographs. Each has its own descriptive sentence, and each is placed adjacent to the text it is intended to support. The illustrations of core memory and magnetic bubble memory are especially helpful.

There's also an extensive index and bibliography. However, a book with only 111 pages of text doesn't need three pages of index; the table of contents is adequate. The bibliography lists seven books, and although I cannot quarrel with the selection, several seem too advanced to recommend to a junior high school student.

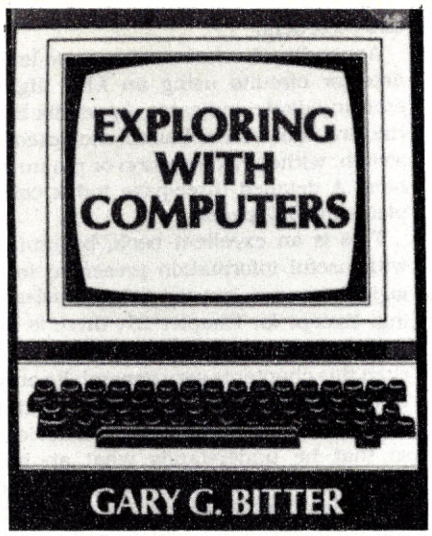
The reservations above are minor. The book is a fine introduction to the broad field of computers and their current applications. If you've got a youngster whose interest in computers you'd like to nurture, give him or her a copy of *Computers in Your Life.*

Exploring with Computers

Gary Bitter
Julian Messner, 1981
Hardcover, 64 pp.

Exploring with Computers is aimed at fifth, sixth and seventh graders, who will appreciate the author's straightforward, unpatronizing tone. The ten-page, thoughtfully illustrated beginning section on the history of computers dutifully mentions the key figures: Pascal, Morland, Leibniz, Babbage, Jacquard, Hollerith and several giants of 20th century computerdom.

In describing how a computer works, Bitter correlates the brain's operations with those of the computer through the stages of a single problem. This lends a framework to the subsequent descriptions of input, central processing unit, arithmetic unit, memory and output. On their first appearance in the text, key words are italicized. This is a nice feature, but I would have liked a glossary of those terms—there is none. The book continues with brief sections on hard-



ware and software, computer types, computer uses and misuses, careers and a look into the near future.

At this point Bitter could have switched off his typewriter and had a passable, although rather short, book to send to his publisher. Instead he pushes on, improving the effort immeasurably with the addition of a 15-page chapter "Computer-Related Activities for You." He shows how and why to write a flowchart, with an example first from the reader's own experiences, and then with a practical problem—programming a robot through a prescribed set of movements. Another exercise presents a simple BASIC program, whose elements are explained with elegant brevity.

There's more: I'd never have the audacity to try to explain to a ten-year-old how to read the holes in an IBM card, let alone actually hope to succeed at it. Bitter does this neatly in only five pages.

My complaints are both few and minor. The term debug is used without explanation—add that to the new glossary in the second edition, please. My last complaint refers to one of the many excellent photographs in the book. The photo in question is of the keyboard unit of a TRS-80 Model I, with the power supply visible behind it. The caption reads, "This is a microcomputer, controlled by the CPU behind the keyboard." This caption is at best misleading.

By now hundreds of thousands of elementary students are using computers in school, but little reading is available for them. We could use many more books that are as good as *Exploring with Computers*.

Dennis C. Cullinan
East Lansing MI

6502 Software Design

Leo J. Scanlon
H.W. Sams Co., 1980
Softbound, 296 pp., $12.95

In *6502 Software Design*, Scanlon has done an excellent job of presenting topics of interest to the programmer working in machine language. He begins the book with a brief history of the development of the 6502 microprocessor and how this design history affected the processor's architecture. Chapters two and three provide an overview of the 6502 instruction set, addressing modes and use of subroutines. Chapter three includes an extensive section on developing software time-delay routines.

The remaining chapters of the book cover, in order, lists and look-up tables, mathematical routines, number base conversions, interrupts and resets, general purpose input/output devices and techniques. Two appendices cover the ASCII character set and a summary of the 6502 instruction set.

Most of the chapters are excellent, with each example and explanation building on material presented previously and setting the stage for information to follow.

This building-block approach is both enjoyable and understandable. Scanlon doesn't cover everything about software design, but he does equip the reader to try more complex routines than are presented in the book.

I do have some complaints about *6502 Software Design*. First, Scanlon is an employee of Rockwell International and has chosen the AIM 65 microcomputer as the system to present example software for. This is a minor inconvenience to all of us who must convert keyboard or display routines for other systems. This information could have been included with the examples.

Second, the chapter on the 6520 PIA and 6522 VIA devices was not as clear and easy to follow as the rest of the book. In fact, I felt it was harder to follow than much of the information published elsewhere on these useful interface chips.

On the whole, this book is a valuable addition to your library whether you own an Apple or a KIM, especially if you are just getting into machine-language programming.

Thomas Franks
Wadsworth, OH

From ENIAC to UNIVAC: An Appraisal of the Eckert-Mauchly Computers

Nancy Stern
Digital Press
Hardcover, 286 pp., $25.

Don't let the title fool you. *From ENIAC to UNIVAC* is an interesting, informative and well-written account of the now-famous mainframes developed by J. Presper Eckert and John W. Mauchly in the 40s and 50s. It analyzes the personal, scientific and social dynamics that led to these monstrous progenitors, and explains why you're not reading *Adding Machine* magazine right now.

While the theories that eventually laid the groundwork for our first computers had been kicking around for a number of years, it took a combination of factors before scientists and engineers actually got around to building one. First, and perhaps foremost, was World War II. As Stern says in her conclusions, "the major factors affecting the technological development of computers were frequently not scientific but social, administrative, even political ones."

The Army's Ballistics Research Laboratory was in a quandary, unable to compute firing tables for new artillery. They needed faster equipment, and this need, says Stern, was "the single most important impetus to technological development in the field of electronic digital computers in the United States."

At the same time, Eckert and Mauchly rose to prominence at the Moore School of Electrical Engineering at the University of Pennsylvania. Mauchly enrolled in a summer course entitled "Engineering, Science, Management War Training" in 1941, and was offered a position on the school's staff. There he met Eckert; the two, along with others associated with the school, eventually built the ENIAC (Electronic Numerical Integrator and Computer), the first computer as we would come to know them.

The book follows Eckert and Mauchly through their many trials and tribulations. While the scientists who worked on the ENIAC pulled together for the war effort, they afterwards fell to bickering and dissension. Eckert and Mauchly wanted to pursue commercial interests, an idea that offended their academic colleagues. They also were involved in several disputes over who had actually invented what, the worst of which was with the eminent mathematician John von Neumann after von Neumann wrote a report on the EDVAC (Electronic Discrete Variable Automatic Computer) without giving Eckert and Mauchly equal billing.

Eckert and Mauchly eventually went on to form their own company. Here they developed the smaller BINAC (Binary Northrop Aircraft Computer), and the UNIVAC (Universal Automatic Computer). Unfortunately, they didn't have much business sense, and consistently underestimated the cost of their projects and the postwar commercial viability of computers. "Eckert and Mauchly were more than optimistic, they were naive," Stern says.

In 1950, the Eckert-Mauchly Computer Corporation, on the brink of financial disaster, sold out to Remington Rand. The first UNIVAC was sold in March of 1951, to the Census Bureau.

This book is filled with interesting and absurd facts. For example, the ENIAC had 17,468 tubes, occupied 1800 square feet and divided in 24,000 microseconds. Its average error-free running time was 5.6 hours. It had no main memory, and programming was done through manual wire panels.

For computer historians, hardware freaks and masochists, the last 66 pages of the book are devoted to von Neumann's "First Draft of a Report on the EDVAC," the computer the Moore School developed immediately after the ENIAC.

Stern's book breathes some life into a subject that could otherwise be stuffy and dull. It shows that computers didn't merely emerge from the primordial swamp of technology full-blown and fired up, but resulted from a series of quirky historical events involving a bunch of quirky people. It makes you wonder what's going on out there right now.

Eric Maloney
***Microcomputing* staff**

Digital Electronics Troubleshooting

Joseph J. Carr
Tab Books, Inc.
Paperback, 352 pp., $9.95

Digital Electronics Troubleshooting is written for technicians, radio amateurs, technical school students and experimenters who have already studied basic electronics but want to understand the principles behind digital electronic circuits in order to troubleshoot and maintain them.

The book's first three chapters provide an overview of digital electronics and a complete explanation of digital numbering systems (binary, octal, decimal and hexadecimal) including specific methods for number conversion between systems. The most common code schemes used in digital circuits to represent binary data are covered in detail, including hexadecimal code, split-octal code, binary-coded decimal, excess-3 code, Gray code, Baudot code, ASCII code and EBCDIC. Various tables and charts illustrate and define the different codes.

Chapter 4 details the different digital logic families—TTL, CMOS, RTL, DTL, ECL, HTL and Schottky TTL. This is followed by separate chapters covering logic gates, arithmetic circuits, flip-flops, counters, display devices, decoders, registers, timers, multivibrators, data multiplexers and data selectors. Throughout this section of the book, specific common TTL and CMOS integrated circuit devices are described (including pin-outs) and several logic-gate experiments are detailed for hands-on experience.

Chapters 14–18 are primarily of interest to those involved with data transmission and computer applications. Parallel, serial and current-loop interfaces are described, with particular emphasis on UART (universal asynchronous receiver-transmitter) chips and telephone line use. Computers and microprocessors are generally discussed, with details of the Zilog Z-80 registers and pin functions. Memory input/output interfacing and data conversion (analog-to-digital and digital-to-analog) with circuits are covered in separate chapters.

Chapter 19 has formulas and circuits for dc power supplies for digital equipment, including overvoltage protection and output current-limiting. Test equipment for electronic equipment is briefly discussed in Chapter 20, with a short description of logic probes and logic analyzers. Chapter 21 finally gets into actual troubleshooting, with descriptions of common problems—power supply, temperature, power line voltage and transients, glitches, passive and active bus termination, ringing and radio-frequency interference. Unfortunately, this chapter is only 15 pages long!

The final chapter covers computer peripheral equipment, and includes brief descriptions of printers, paper tape readers, magnetic storage devices and plotters/recorders.

Appendix A shows two logic-level detector circuits using an LED (light-emitting diode) indicator. Appendix B is the circuit of a four-channel oscilloscope switch, without explanation or pin numbers. A detailed three-page index completes the 352 pages.

This is an excellent book, brimming with useful information presented in a logical manner, but the title is misleading. Except for Chapter 21, there is no specific reference to troubleshooting and even this chapter is very general. Its only value in troubleshooting is to acquaint the reader with digital design and devices so that he understands what an improperly functioning circuit *should* be doing. Reading this book will not teach you troubleshooting, which really takes considerable hands-on experience.

Unfortunately, there are lots of errors and omissions in both the text and the illustrations. It's tough enough for a newcomer to comprehend a subject as complex as digital electronics without having to cope with numerous printing errors.

However, don't let this prevent you from buying this book if you don't already have an extensive digital library. It's a virtual encyclopedia of digital information—even if it isn't really a troubleshooting book—and I'm certainly hanging onto mine.

Fred Blechman
Canoga Park, CA

Programming the Z8000

Richard Mateosian
Sybex, 1980
Paperback, 312 pp., $15.95

Back in the good old days before micros, when you bought a minicomputer, no matter how small or inexpensive, you got a plastic tray or two full of punched

✓See List of Advertisers on page 210

paper tapes. These tapes contained editors, assemblers, debuggers and sometimes even operating systems, at no extra charge. All you needed to get your new minicomputer running was a terminal and a paper tape reader. The computer was sold complete with all the software you needed to edit, assemble, load and run your programs. The last mini I purchased included the computer, 4K bytes of core memory and all the software and documentation required. All for $2000.

Now you can buy one of the new 16-bit micros for about $100, for the CPU chip alone. If you want to use the chip, you're in trouble since you don't get an assembler with it. Most manufacturers won't even sell you one that runs on your new 16-bit processor. They expect you to spend between $12,000 and $25,000 for a development system based on an old 8-bit micro. Then for an additional $1200 to $2000 you can purchase an assembler that will run on the 8-bit machine, to generate the object code for your 16-bit micro. This is progress?

All of this is to point out how valuable *Programming the Z8000* can be to anyone dedicated to using this new superchip. If you have to get a Z8000 going and have a limited budget, you might as well resign yourself to handcoding your own resident assembler. The first tool you will need will be Zilog's Z8000 programming manual. Next you would be well advised to buy Mateosian's book. The combination will have you well on your way to understanding the internals of the Z8000.

Programming the Z8000 covers a lot of material. It discusses how the bit patterns within the machine-language instructions are arranged. This subject is ignored in Zilog's manual, since they expect you to buy their assembler. The book then gives sample programs for communicating with a terminal, among many other examples. Each instruction in the programs is discussed, enabling the reader to learn assembly-language programming as well as the Z8000 instruction set. With this book the dedicated experimenter could get a minimal system up and running and learn enough to be able to write a complete assembler himself.

Now for the bad news. This is not the most readable book I've ever seen. Stringing multiple instructions together on one line does not make assembly-language programs readable. The author admits that this is a matter of style, and I admit that more experienced programmers will not find this much of a disadvantage. But a newcomer to the Z8000 would have been better served if the program examples had one instruction per line and used the remaining space for detailed comments.

Since certain parts of the book—like the 57 pages of instruction set descriptions, in particular—will become a heavily referenced set of sheets, the book would have been much more usable if it had been bound so you could open it out flat without destroying the binding.

Of course, it is what is on the pages that is important. Mateosian's breakdown of the instruction set, showing which bits control what functions in the Z8000, is vital to the kind of hackers who will be trying to build up a Z8000 computer from scratch. But this kind of endeavor is for the dedicated, and this book will take some studying. It is not for beginners, nor is it necessary for those fortunates who have access to an exotic development system. But for the rest of us crazies all I can say is that I wouldn't be without it.

You might have trouble identifying this book, however. The cover artist got carried away and the illustration which is supposed to look like Z8000 has been so stylistically rendered that it looks more like a chrome-plated gear shift lever chasing a bunch of billiard balls.

The title on the edge of the binder is readable, though. If you can find it, buy it.

Ken Barbier
Borrego Springs, CA

APF Technical Reference Manual

APF Electronics
Softbound, 80 pp.

While this manual is for the technical person, it includes material that will help both beginning BASIC and assembly-language programmers. Both the MP1000 game computer and the Imagination Machine itself are covered.

Tips are given to BASIC programmers for saving memory space and speeding up program execution. A chapter is devoted to assembly-language programming, as is one to useful routines. Short programs are given to demonstrate various tricks that can be done with the APF.

Low and high resolution graphics are explained much more thoroughly than in the instruction manual supplied with the computer. The APF owner's manual only tells you the BASIC words allowed and a little about each one. This manual is a nice addition.

The book includes block diagrams, system timing, memory maps, MC6800 instruction sets, schematics, parts layout, keyboard matrix, reserved words and ASCII codes.

You'll never experience the full potential of the APF Imagination Machine without this handbook, no matter what level of microcomputing you may find yourself at.

Dan Keen
Cape May Courthouse, NJ

Years of conquering, years of victory and what do people remember Napoleon for? Waterloo. You've got to have . . .

STRATEGY

It's an acquired skill. And now, Instant Software has three programs to help you sharpen your tactical thinking. Don't make the same mistake Napoleon made—practice first, with Instant Software.

"NOW they tell me."

OIL TYCOON

What would it be like to be one of the world's biggest oil producers? You and your friends can find out with this action-packed simulation as you compete to become one of the oil industry's wealthiest tycoons.

The game involves elements of both strategy and chance. Whether you wind up as one of the world's wealthiest men, or the bankrupt victim of too many oil spills, blowouts, and dry wells, you're sure to find Oil Tycoon both challenging and exciting. TRS-80 Model I and III Level II, 16K RAM.
0023R-A51 TRS-80* tape $9.95 plus $2.50 shipping.

MASTER REVERSI

Master Reversi is a tournament-winning game program that has more features than any other reversi program on the market. It will challenge and teach you no matter what your degree of expertise.

What makes Master Reversi really special is its ability to allow in-depth analysis of moves and games. You may examine the computer's evaluation and choice of moves. You can save and replay interesting moves and games. You will be able to study and manipulate dozens of tournament-level games which are provided in the program's vast library.

Master Reversi will enable you to overcome any barriers standing between you and a world championship. Model I, Level II, 16K, expansion interface, 1 disk drive. Not Mod III compatible.
0378RD-A52 TRS-80* Disk $29.95 plus $2.50 shipping.

SANTA PARAVIA AND FIUMACCIO

The year is A.D. 1400, and you are the ruler of a tiny Italian city-state. You are ambitious by nature and intend to build your little city-state into a powerful kingdom.

So begins Santa Paravia and Fiumaccio, where you and your fellow players compete as rulers of neighboring cities. You control the grain harvest, feed your people, set tax rates, exercise justice, and invest in public works.

Life was short back then, and you'll have only a limited amount of time in which to build your kingdom. The lives of your serfs will depend on your decisions. If they are wise, then your city-state will grow and you will acquire loftier titles. If your rule is incompetent, your people will starve and your city-state may be invaded by your neighbors.

How will you rule your kingdom? Will you become unscrupulous and follow the examples set by Niccolo Machiavelli in his book on government, The Prince—or will you be a benevolent ruler—an iron fist in a velvet glove? Only you can answer that question—with the Santa Paravia and Fiumaccio program.

Level I & II, 16K **0043R-A46 TRS-80* tape $9.95.**
Applesoft in ROM, 48K **0174A-A47 Apple tape $9.95.**
Applesoft in ROM, 48K **0229 AD-A48 Apple** disk $19.95.**
TI 99/4, 16K **0273TI-A50 Texas Instruments tape $9.95.**

plus $2.50 shipping.

Our Guarantee

Defective software may be returned for exact replacement at no cost to you, or for full credit, within thirty days of the invoice date. You MUST enclose dated proof of purchase for any replacement to be made, so please keep your invoice.

Should a disk or cassette become defective after the warranty period, Instant Software will still protect you. You may return the defective cassette along with $4.00, or any disk with $5.00 for a replacement. Again, you must provide us with a copy of your invoice for any return to be made.

TO ORDER:

See your local Instant Software dealer or call toll-free
1-800-258-5473
orders only
In New Hampshire
1-603-924-7296
Mon.-Fri. 8:00 am-4:30 pm E.S.T.

Instant Software™

Peterborough, N.H. 03458 A division of Wayne Green Inc. ✓404

*TRS-80 is a trademark of Radio Shack division of Tandy Corp.
**Apple is a trademark of Apple Computer Co.

PERSPECTIVES

(from page 242.)

There might be regulations regarding how the records are to be kept. For example, a federal regulation might require that quality assurance records from the production of a batch of serum be kept for seven years. Furthermore, it must be readable—this means printed reports (not disk or tape)—and it also must be nonthermal (since some thermal paper fades after a period of years).

10. How many and what sort of people will be using the system? Office personnel, salespeople, managers, owners, loading dock people, customers. This will have an impact on the operator interface and its level of user-friendliness.

11. How long can the system hardware be down before it has a serious effect on the business? This question will determine the level of hardware reliability of the system. It might be necessary to institute a series of backup measures for a hardware failure. For example, some form of hardware service contract, redundant hardware, short-term rental agreement worked out in advance, a 24-hour-a-day service contract with a specified response time.

You need to determine how expensive down-time is to the client before you choose a backup measure. Keep in mind that there are hardware failures other than a failed component. For example, noisy ac line, power outage, dirty or poor quality media, theft, improper environment for the system (temperature, humidity, static).

12. How long can the system software be down before it has a serious effect on the business ? Some of the software measures that you can take are software service contract, programmer on call, the quality assurance/testing phase of software development. This list points up a fundamental difference between the hardware and software. It is possible to spend enough money (for the redundant hardware) to ensure that the system will keep running. It is not quite that easy

"Unless you're telepathic, never assume you understand what your client is saying."

with software. The first two options might be adequate, but it is my belief that the only way to really provide any assurance of software up-time is to build it in (at design time) and test it in (during the testing phase).

13. What, if any, manual backup systems do you want to maintain with the computer system? This has a major impact on the design of the system. It can affect the design of the programs, databases and operating procedures.

14. How much do you want to spend on the total system? All the front-end costs, including hardware, software, system integration, training. It is best to get a range that the client can afford and then show the client the trade-offs and what can be upgraded at a later date (if a trade-off was made). (You can suggest a less reliable printer but don't recommend a less reliable disk.)

15. How much do you want to spend on continuing support? Retraining, system modification, hardware maintenance, software support and machine rental (a real alternative).

In some ways this questionnaire can be intimidating. It makes the client consider the possibility of hardware and software failures, long switch-over periods, system growth and maintenance. The client might have thought he could buy everything off the shelf (and some salespeople might agree). The questions (and the communication between the client and consultant) may be difficult, but it is unlikely that a good system will be developed without them.

When you are ready to talk with a client, use a two-pass proposal. The first proposal will state that you will do the initial system analysis for a specified fee. The product of this analysis will be a second proposal which will be your complete system proposal.

The Fee

There are two important questions with regard to the consultant's fee—how much and in what way do I get paid?

The amount is arbitrary. Remember that you are doing the consulting on your own time. Be sure to take into account the cost of travel, equipment and supplies. Also, don't overcharge based on your talents. Take into account if this is your first consulting job or if it is outside of your expertise.

You will need to pay income tax on your consulting income. Check with the current federal, state and local government regulations with regard to self-employment income. It is very important to check immediately, because income that is a major portion of your annual salary is subject to taxes every quarter. If you wait until April 15th, you might have to pay a penalty and interest above and beyond the taxes.

There are several ways that the fee can work. One way is to bid on the whole system and the consultant will provide almost everything. I would not suggest doing this unless you are very experienced in the application and with consulting in general. A better approach for a first-time consultant is to charge an hourly or daily rate. This way, if you miscalculate how long the application will take, it is not disastrous for you.

It is wise for a consultant to set up an agreed-upon method for payment. Some of the possibilities might be: one lump sum at the start of the project; a lump sum at the end of the project; regular monthly payments; partial payment at the completion of project checkpoints. I recommend the partial payment at project checkpoints. This shows the client where his money is going.

Conclusions

Now you know what consulting is—a professional activity that you can perform. Finding clients can sometimes be difficult, but you have some places to start looking—computer stores and the general business community.

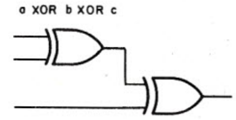
Communication is a fundamental part of the client/consultant relationship. The system requirements questionnaire is a tool to assist you in those communications. As a final suggestion, you should always act in a professional manner—organized, competent, knowledgeable. That is why you were hired. □

MICRO QUIZ

(from page 12.)

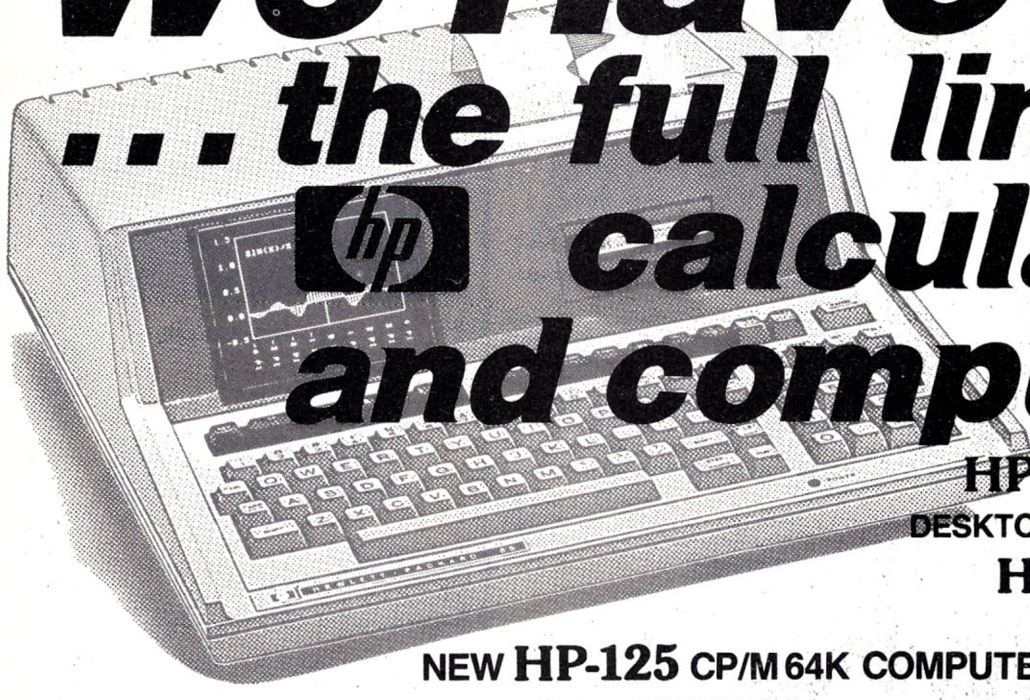
Answer:

a XOR b XOR c



We Have It !

...the full line of hp calculators and computers



HP-85A SELF CONTAINED DESKTOP COMPUTER. $2,595

HP-83A . . . $1,749

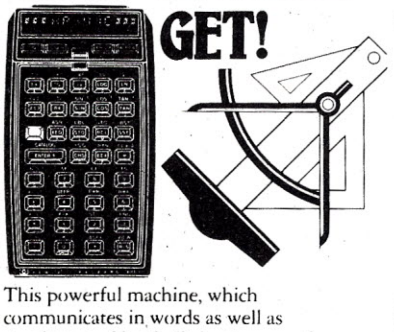
NEW HP-125 CP/M 64K COMPUTER SYSTEM. . $3,179

PERIPHERALS

- *HP2902M 5.25 SINGLE MASTER DISK DRIVE $1269
- *HP2901M 5.25 DUAL MASTER DISK DRIVE $2125
- *HP9895 OPT010 8" SINGLE MASTER DISK DRIVE. $4239
- HP9895A 8" DUAL
- *MASTER DISK DRIVE. $4439
- HP7225B OPT2 GRAPHICS PLOTTER $2195
- *HP17601A PERSONALITY MODULE-PLOTTER $675
- *HP17603A PLOTTER PERSONALITY MODULE RS232. . . . . $675
- *HP2631B OPT885 180 CPS DOT MATRIX PRTR. $3360
- *HP82905A DOT MATRIX PRINTER . . . $799
- *HP2601A DAISYWHL. LETTER QUAL. PRINT. $3249
- HP82903A 16K HP85 MEM. MOD. $249
- HP00085-15001 HP85 MASS STOR. ROM $131
- HP00085-15002 HP85 PLOT./PRINT. ROM $131
- HP00085-15003 HP85 I/O ENHANC. ROM. $265
- HP00085-15004 HP85 MATRIX ROM $130
- HP82937A HP85 HP-IB INTERF. MOD.. . . . . $355
- HP82940A HP85 GPIO INTERF. $429
- HP82941A HP85 BCD INTERF. $445
- HP82949A PARL. PRINT. INTERF. . . . $265
- HP82939A EIA SER. INTERF. $355

*Also used with new HP125

GET ALL THE HELP YOU CAN GET!



This powerful machine, which communicates in words as well as numbers, and has built-in memory of over 400 program lines, can grow into a complete computational system. Expand memory. Redefine keyboard. Add Card Reader, Printer/Plotter, and Application Modules for solutions to your real-world problems.

HEWLETT PACKARD

The HP-41C

HP41C $189

HP41CV. $259

- HP82106A MEMORY MODULE $28
- HP82170A QUAD MEMORY MODULE . . .$85
- HP82104A CARD READER FOR 41C/CV $179
- HP82143A PRINTER FOR 41C/CV $319
- HP82153A OPTICAL WAND FOR 41C/CV $109

The HP-11C gives you the power to simplify repetitive calculations with such advanced programming features as subroutines, conditional tests, controlled looping and indirect addressing.

HP11C $119

The HP-12C's programmability and extensive function set are complemented by its handsome, slim-line design. Your HP-12C will travel comfortably in your shirt pocket, ready to solve your problems wherever you go.

HP12C $129

- HP32E SCI. W/STATICS $49
- HP33C PROG. SCI.-CONT. MEM. $79
- HP34C ADV. PROG. SCI. CONT. MEM. $127
- HP37E BUS. CALC. $66
- HP38C ADV. FIN. PROG. CONT. MEM. $127
- HP67 PROG. CALC. $315
- HP97 DESK. PROG. PRINT. $629

WRITE FOR FREE CATALOG.

Above prices reflect a 2% cash discount (order prepaid prior to shipment). Prices are subject to change and offers subject to withdrawal without notice.

master charge THE INTERBANK CARD

Mini Micro Mart, Inc.

VISA

943 W. Genesee St. Syracuse, N.Y. 13204 (315)422-4467

50

By Tim Mikkelsen

So, You Want To Be A Consultant

Testing The Open Market

Any time that you, as a computer professional, perform technical work outside of your full-time job, you are consulting. Consulting is a wide-ranging term. As it relates to computers, it includes:

- systems analysis
- business programming
- scientific programming
- system configuration
- system recommendations
- system maintenance
- system troubleshooting

Consulting can be a very exciting and profitable activity; however, as we shall see, it is not always easy.

Where to Find Consulting Work

Computer professionals have skills for which a client is willing to pay. How do you find clients in need of your services? Some fairly simple methods are:

- Run advertisements in local newspapers.
- Make arrangements with retail computer stores to put your name on a list of consultants.
- Contact computer manufacturers. Many times they keep a list of consultants, which allows them to offer complete systems—their hardware and system software and a software consultant to customize the system.
- Check the phone book yellow pages for possible clients.
- Contact the local government agencies (city, county, state and federal), which occasionally make use of consultants.

A word of warning—most of you are employed, full time, for your technical skills. Your company probably has some policy regarding outside employment. In the company's eyes, consulting might be a nice word for conflict of interest. Be sure to check with your supervisor, personnel manager or other appropriate person. Consulting can be lucrative, but it might not seem as attractive when it is your only source of income.

What to Do with a Client

Clients are a strange and unusual breed; they require very special handling and care. Unless you are telepathic, never assume you understand what your client is saying. The client can say something that makes sense to both of you, but means two entirely different things. For example, your client says that he has used computers before. You understand him to mean that he has programmed before. He meant that he assembled card decks and fed them into a remote job entry station.

Questionnaire

I have included a systems requirements questionnaire, intended to direct both the client and consultant towards a well-defined, well-documented description of a proposed computer system. This questionnaire is only a guideline. It does not include every question necessary for all applications. It is for the class of consulting that is most common—business applications. Since it is very open-ended, it can, and sometimes should, take a long time or several iterations to complete.

1. *What do you expect the computer to do?* For example, do you want accounts payable, inventory, a real-time flight simulator, a management information system, process control?

2. *Describe as completely as possible the tasks in question 1.* For inventory applications, an example might be:
Database Description—number on hand, lower limit for restock alarm, upper limit for overstock alarm, vendor, color, size, location in warehouse, retail and wholesale prices, links to items that might be a substitute.
Operations on Inventory Database—add an item, delete an item, update an item, examine current status, list restock needs, list overstock items, calculate profit for a sale on an item.
Miscellaneous—approximately 400,000 items in inventory; the inventory files are to be on line; only certain people can add, delete or edit an inventory item.

3. *What sort of growth or changes do you expect for the description in question 2?* For example, ZIP codes going from five to nine digits, or adding a new field to inventory items to account for product smell.

4. *List any peculiarities of your business or the jobs you are expecting the computer to perform.* For example, the owner of the company has to have a good implementation of backgammon available on the system. The company payroll regularly deals with transient workers (they might not have a permanent address or social security number). The inventory has large fluctuations, on a seasonal cycle (or on no cycle). The system needs to be able to handle simultaneous on-line sales, receiving, shipping and management inquiries (this implies some database lockout mechanism to ensure there is always correct data in the database).

5. *From the list in question 1, what is the minimum you will be satisfied with for the first running system?* If the client wants a large system, he should start out small and slowly build up to the maximum system. This limits the amount of work and equipment invested before the client sees the system (in case the client doesn't like some aspect of the system). It will give the employees the opportunity to become familiar with the idea of a computer and the system you are implementing.

6. *Over what period of time will it be acceptable to build up from the minimum system to the total system?*

7. *Is there a good time to get the system up and running?* Does the business have a seasonal lull or holiday hiatus?

8. *What sort of switch-over to the computer do you want to have?* Some options are complete overnight conversion, phased introduction of each portion of the new system and a parallel operation of both systems for an arbitrary period of time.

9. *What long-term information needs to be stored, how long does it need to be kept and in what form must it be stored?* An example for an inventory system might be: Once a month the inventory files are dumped to tape for archival storage (not at the business site). Also, each month the transactions to the inventory are dumped for archival storage (so at least a partial inventory can be regenerated in case the on-line files are destroyed). The monthly files are kept for four months and then recycled. Once a year the inventory is dumped to tape and saved for ten years.

(continued on page 238)

Address correspondence to Tim Mikkelsen, 3284 Silverthorne Drive, Fort Collins, CO 80526.